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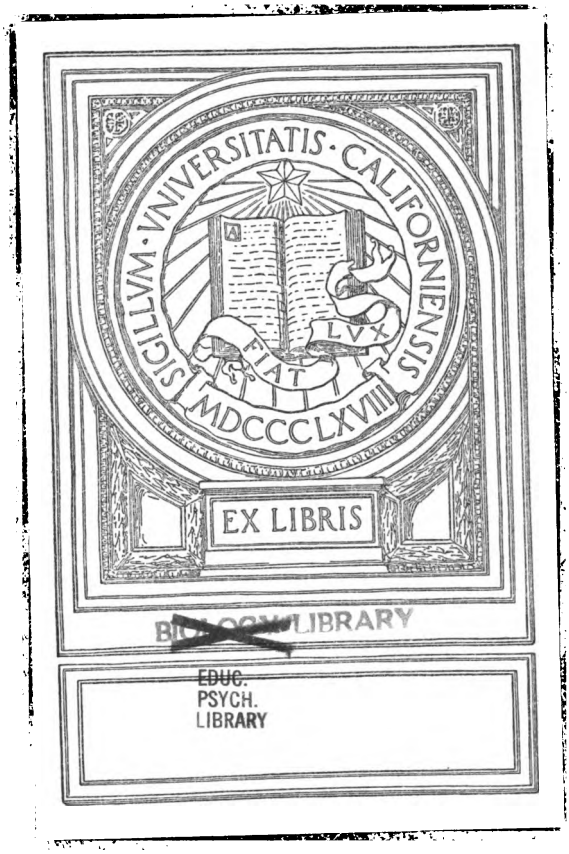

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THE JOURNAL
OF
MENTAL SCIENCE

BY AUTHORITY OF
THE ROYAL MEDICO-PSYCHOLOGICAL ASSOCIATION

MANAGING EDITOR
G. W. T. H. FLEMING

IN COLLABORATION WITH
Douglas McRae **Alexander Walk**

AND WITH THE ASSISTANCE OF

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"In adopting our title of the *Journal of Mental Science, published by authority of the Medico-Psychological Association*, we profess that we cultivate in our pages mental science of a particular kind, namely, such mental science as appertains to medical men who are engaged in the treatment of the insane. But it has been objected that the term mental science is inapplicable, and that the term mental physiology or mental pathology, or psychology, or psychiatry (a term much affected by our German brethren), would have been more correct and appropriate; and that, moreover, we do not deal in mental science, which is properly the sphere of the aspiring metaphysical intellect. If mental science is strictly synonymous with metaphysics, these objections are certainly valid; for although we do not eschew metaphysical discussion, the aim of this JOURNAL is certainly bent upon more attainable objects than the pursuit of those recondite inquiries which have occupied the most ambitious intellects from the time of Plato to the present, with so much labour and so little result. But while we admit that metaphysics may be called one department of mental science, we maintain that mental physiology and mental pathology are also mental science under a different aspect. While metaphysics may be called speculative mental science, mental physiology and pathology, with their vast range of inquiry into insanity, education, crime, and all things which tend to preserve mental health, or to produce mental disease, are not less questions of mental science in its practical, that is in its sociological point of view. If it were not unjust to high mathematics to compare it in any way with abstruse metaphysics, it would illustrate our meaning to say that our practical mental science would fairly bear the same relation to the mental science of the metaphysicians as applied mathematics bears to the pure science. In both instances the aim of the pure science is the attainment of abstract truth; its utility, however, frequently going no further than to serve as a gymnasium for the intellect. In both instances the mixed science aims at, and, to a certain extent, attains immediate practical results of the greatest utility to the welfare of mankind; we therefore maintain that our JOURNAL is not inaptly called the *Journal of Mental Science*, although the science may only attempt to deal with sociological and medical inquiries, relating either to the preservation of the health of the mind or to the amelioration or cure of its diseases; and although not soaring to the height of abstruse metaphysics, we only aim at such metaphysical knowledge as may be available to our purposes, as the mechanician uses the formularies of mathematics. This is our view of the kind of mental science which physicians engaged in the grave responsibility of caring for the mental health of their fellow-men may, in all modesty, pretend to cultivate; and while we cannot doubt that all additions to our certain knowledge in the speculative department of the science will be great gain, the necessities of duty and of danger must ever compel us to pursue that knowledge which is to be obtained in the practical departments of science with the earnestness of real workmen. The captain of a ship would be none the worse for being well acquainted with the higher branches of astronomical science, but it is the practical part of that science as it is applicable to navigation which he is compelled to study."—*Sir J. C. Bucknill, M.D., F.R.S.* (*Journ. Ment. Sci.*, vol. vii, 1861, p. 137).

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JOURNAL OF MENTAL SCIENCE

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Part I.—Original Articles.

A STUDY ON THE SYMPTOMATOLOGY AND DIFFERENTIAL DIAGNOSIS OF ALZHEIMER'S DISEASE AND PICK'S DISEASE.

By E. STENGEL, M.D.Vienna,

Royal Edinburgh Hospital for Nervous and Mental Diseases.

[Received September 16, 1942.]

MANY problems concerning Alzheimer's disease and Pick's disease are still awaiting clarification. In this country Henderson was the first to draw attention to the considerable importance of Alzheimer's disease in clinical psychiatry. Valuable work has been contributed by various writers in recent years (Grunthal, 1936; Critchley, 1929, 1930, 1931, 1938; Schottky, 1932; Thorpe, 1932; Rothschild, 1934; Malamud, Lowenberg and co-workers, 1929; Mayer-Gross, 1938; Kasanin and Crank, 1933; Jervis and Soltz, 1936; McMenemy, a.o., 1939). While Pick's disease has retained its position as a clinical entity based mainly on the characteristic anatomical picture, the position of Alzheimer's disease in the system of psychiatry has become more complicated; for instance atypical cases have been described presenting the anatomical characters of Alzheimer's disease, though not fitting into the original clinical conception of that disease. Lowenberg and his co-workers (1929) are inclined to regard Alzheimer's disease as a syndrome rather than a clinical entity. Many contributors have directed their main interest to the pathological changes. The knowledge of the symptomatology of those conditions is still incomplete. Further intensive study may enable us not only to base the diagnosis and differential diagnosis of Alzheimer's disease and Pick's disease on more solid clinical knowledge than hitherto, but also to recognize the early stages of those diseases before advancing cerebral degeneration effaces their characteristic clinical features. Unfortunately, most of the cases come under the observation of the psychiatrist only in the later stages of their illness, and it seems that the comparatively small proportion of the mental hospital population they represent does not reflect the incidence of those diseases. It is very likely that many patients die from intercurrent illnesses before their mental condition is recognized or sufficiently advanced to make admission to a mental hospital necessary. The differential diagnosis of those conditions offers considerable difficulties which often may prove insuperable. Alzheimer's disease and Pick's disease have to be distinguished not only from each other but from conditions of vascular origin, from senile dementia and various atypical conditions which occur at the same age period during which Alzheimer's disease and Pick's disease usually develop. Only careful collection and analysis of clinical observations and their scrutiny by pathological investigations can increase our still limited knowledge in this important field of psychiatry.

It is not intended on this occasion to discuss all the problems connected with Alzheimer's disease and Pick's disease, but only those which arise from the clinical material presented; nor is it intended to quote the literature in full—for this

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Henderson's (1941), Critchley's (1938), Rothschild's (1934), Grunthal's (1936) and McMenemy's (1940) articles should be consulted. It is proposed to deal in this paper with the symptomatology and differential diagnosis of those conditions on the basis of observations made in a series of cases which had been clinically diagnosed by Prof. Henderson and anatomically verified by Prof. Biggart, Dr. Campbell and Dr. Blackwood, at the Scottish Mental Hospitals Laboratory. The encephalographic and electroencephalographic examinations were carried out at the Department of Neurosurgery (Mr. Norman Dott) of the Royal Infirmary, Edinburgh.

CASE 1.—Mrs. J. B. T—, aged 56, admitted on 22.x.1937. *Family history:* Father alcoholic; died of cancer of the throat, aged 65. Mother died aged 68. Eight siblings. No family history of nervous and mental diseases. *Personal history:* The patient was an athletic woman, fond of games and music, a good wife and mother (one child); never physically ill. Four years previous to admission she was noticed to lose her memory; one year later she collapsed and was unconscious for a few minutes, the description of that incident being suggestive of a major epileptic fit. Then she became progressively worse and for the last six months before admission she was unable to look after herself, slept with her clothes on, and had to be fed. Her speech was incoherent, she appeared to see things that were not there; she was emotionally unstable and subject to fits of weeping. Latterly she failed to recognize her relatives, referred to the dog as a baby and asked if he were going to school. She lived in her reminiscences and was unable to remember recent events. She was restless and distressed, wandered out into the streets and became excited if one tried to detain her; on such occasions she broke door handles and a glass panel in the house.

Behaviour on admission.—The patient is extremely restless, sitting up all day fumbling with the bedclothes. She frequently appears distressed, at other times she is smiling and cheerful. Understanding of spoken language greatly impaired. Specimen of conversation. (What is your name?) "Wait . . . I can't wear . . . If you hear it in the house . . . yes . . . try if you want to . . . 2–3 . . . I think that is all." (Where do you live?) "Going . . . one side like this." (Have you brothers and sisters?) "Yes." (How many? "Well, I don't know of course for one and another time, if you left one here and what was here and then that." She sometimes obeys simple commands, but more often fails to understand. She is unable to name objects correctly. (Watch) "It's 5, 1, 3, 2, 4." (Handkerchief) "Nothing," etc. Asked to write she produced some scribbles in which a few irrelevant letters can be distinguished. *Physical examination:* Circulatory, respiratory and alimentary systems normal. B.P. 144/100. Neurological examination negative. C.S.F. negative. *Encephalogram:* The extracerebral subarachnoid space is very capacious. No displacement of the ventricles. slight dilatation of the anterior ends of the lateral ventricles. There is evidence of conspicuous shrinkage of the brain substance, most marked in the anterior half of the brain. Sylvian fissures abnormally large, and over both frontal lobes there are large subarachnoid spaces which dip as between shrunken convolutions. 5.iii.38: Condition materially unchanged. The patient laughs uncontrollably and occasionally she is found weeping for no apparent reason; often she is so agitated and distressed that she runs up and down the ward. Words are repeated in a monotonous fashion. (How are you?) "Yes, oh yes, very good, very, very good, very, very, very." The understanding of spoken language has nearly completely gone. 1.x.38: She is untidy and destructive, especially when attempts are made to keep her in bed; for hours she wanders about the room, rubbing her hands and mumbling. The tendency to senseless repetition of words and syllables has increased. 3.i.39: The patient passed into a state of coma, the right pupil was larger than the left and the tendon reflexes on the right side were increased. 8.i.39: During the last three days the patient sank into unconsciousness and died from bronchopneumonia.

Post-mortem examination (Dr. W. Blackwood).—*Brain:* Subdurally on the left side large collection of blood-stained fluid and blood clot, mainly over the frontal lobe; well-marked neo-membrane on the deep surface; externally the brain shows flattening of the left hemisphere, especially in the frontal region; there is diffuse gyral atrophy. The basal arteries showed some atheroma. On sections no lesions were seen; the ventricular system was slightly dilated. *Microscopically:* Sections from frontal, left parietal, motor occipital cortex and from cornu ammonis show numerous argyrophile plaques in the grey matter as well as in the adjoining parts of the white matter (v. Braunmühl stain). Some plaques in the putamen. Well-marked gliosis in relation to the plaques. Numerous cells with Alzheimer's fibrillary change in the cortical areas examined. No signs of vascular lesions in the cerebral tissue. Subdural haematoma. The deep surface of the dura is thickened by a layer of cellular fibrous tissue in which there are many large blood channels. In one area there appears to have been recent haemorrhage due to rupture of one of these vessels. The naked eye and microscopic examination of the *other organs* revealed bronchiolitis and bronchopneumonia, some atheroma of the abdominal aorta, chronic venous congestion of the liver. Remaining organs normal.

CASE 2.—Mrs. A. S—, aged 61, admitted on 2.i.1936. *Family history:* Father committed suicide for unknown reason; mother was healthy, died at 75. Five brothers, one said to have been "silly" in later life, the others normal and healthy. Patient has been married 33 years and has

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two healthy children. *Personal history:* Patient was a quiet woman, always inclined to be apprehensive and to worry unduly. Husband noticed a change in her behaviour ten years previous to admission. At that time she showed a tendency to repeat things in her conversation, began to fail in her house duties and to do silly things, such as trying to make a pudding in the kettle. Her memory began to fail and she was disorientated. She developed a "mania for dusting the house"; this she used to do twenty to thirty times a day. She used to rise in the small hours of the morning and to work frantically about the house. She collected photographs of her son and latterly used to embrace them and imagine she was feeding the baby. Lately she has been very restless and asked to go to mother (who is dead). She used to complain of severe headaches which came on spasmodically. No fits.

Behaviour on admission.—The facial expression is one of complete contentment. She usually greets the doctor with a pleasantly surprised look as if she was meeting an old friend: her mood is one of pleasure and amusement during the conversation. She is clean and tidy; in the ward she goes about in a quiet way and would appear to be interested in what is going on about her. She does not show perseveration and stereotypy in her general behaviour. These are readily noticed in her speech (see below). There is a definite playful activity present which pervades every encounter one has with her and this tends to distract from the obviousness of her shortcomings. It is difficult to attract her attention and to hold it. She tends to associate freely. Understanding of spoken language is greatly impaired; occasionally she will answer simple questions correctly and comply with simple commands. There is no pressure of talk; she does not produce neologisms, but there is a tendency towards repetition of stereotyped phrases and counting, rhyming and echolalia. Specimen of conversation: (How are you?) "Speaking, very well. Yes, I have been well for a long time." (How old are you?) "How old, well, I be, I think just the whole time, the whole time, it's just gone on now here and there." (What has gone on?) "Em? What will that be now." (What is your home address?) "What will that be now, that will be a good while before we get it, it's right to see you right enough." (Who am I?) "No, the same place now, though." The patient is shown objects. (Watch) "That's 1, 10, 11, 12, is that it? 11 o'clock, these are bonny." (What are?) "This one, the one fo yours. It's very neat." (What is its use?) "For to keep going on the place. That's a nice, that's pretty." (Polishes watch with sleeve.) (Key) "There it is, that's nice, but there, it's very neat." (What is it?) "It, it's just to come here with the working. I am with the rest of them. Some of her's come quick." (Show me how you would use it?) "How do we now, that an' they key (puts in between her fingers). That's my key. I have my little key always there; that's pretty" (fiddles with it and rubs it but never holds it appropriately).(Half-crown coin with King George's head) "Is that a shilling; there's the Queen, that's pretty." (Threepenny coin) "That's like a tree that you can see and they're nice and handy." (Pen) "Wait now, that is, what is it now, 1, 2, 3, 4, would that be too big?" (Touch your nose) "Wait now, touch your nose, this way"(licks finger); "mother there too"(touches her nose for a moment then rubs hands). (Touch your ears)" It is my ear, this ear, it's bonny." (Touch your chin) "Chin" (makes attempts, but touches her right ear). (Can you whistle?) "He can whistle a little, and whistle for the wee tots. What a bonny laddy you are, the wee tots. 1, 2, 3, 4, 5." (Touch your left ear with right hand) "Ear—one—that's better a good deal" (touches left ear with left hand). "I think it should be." The patient is handed over a piece of paper with the words "How old are you?" She looks at it and says: "Free, how old are we, that's the way to make it nice, round about, and that and that." Written on paper—"What is your name?" She examines the paper, turns it upside down. "What is it now? That, the kindness of your, what did you say again? Oh! It would be nicer for you—is your name?" (What is your name?) "My name, Nr. 1 and 2, I think it was, Annie W—" (says her maiden name). (What is your other name?) "My other name, she needs to work herself." (She is handed a paper with "Are you married?" written on it.) "Wait now, ray, what did you call it again, ray, row, it is no mittens." (Read it) "B-r-a-b- you are, r-e how married; what is that word, a-b-r, will that do?" "February number 1." When asked to write she produces either a cross or scribbles. She is able to handle simple objects correctly but fails in more complicated tasks. *Physical examination:* Slightly built woman with a healthy complexion; she looks younger than her age. There is nothing abnormal to be found. No signs of arteriosclerosis. B.P. 126/60. Neurological examination completely negative. W.R. in blood negative. 2.iii.36: The patient gets on pleasantly with everybody, her cheerfulness is excessive, and she giggles and laughs for no obvious reason; there is no fluctuation in this mood. She is suggestible in as far as it is possible by laughing to make her laugh also. She is entirely lacking in the ability to do anything useful apart from looking after her own personal requirements; she does not seem to know how to use simple objects of everyday life; if given a sweeping brush she is quite unable to use it even if shown what to do. She has improved in the matter of dressing herself; on admission she was unable to put on her own clothes, even if they were laid out for her; she would pick them up, inspect them, and eventually lay them down; a month later she was able to dress herself correctly. She was still unable to attend to her own hair or fasten her shoes. On admission she was given the three courses of her dinner at once to see what she would do, and she commenced with the dessert; she was liable also to mix her food up. Now she can take her food correctly; while at first she did not seem to know what to do with her spoon she now can use it correctly. She was originally unable to put in her false teeth; she no longer requires assistance in this matter. 11.iv.36: There are signs of gradual deterioration in her behaviour.

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She does not keep herself clean and tidy and she requires supervision in taking her food. Her conversational abilities have not changed. Recently she has become emaciated and seems to be ageing rapidly. 13.v.37: Within the last week a paresis of the left side has gradually developed. There is a slight left facial palsy involving all branches and a moderate paresis of the left extremities with spasticity. Reflexes exaggerated on the left side. Babinski positive left side. 20.v.37: Died from congestion of the lungs.

Post-mortem examination (Prof. Biggart).—*Brain:* Marked generalized atrophy, more pronounced over the frontal poles. Some fibrotic thickening of the meninges. Vessels at base normal. Pituitary normal. *Microscopically:* Enormous number of argyrophile plaques in all regions of the cortex, particularly in the frontal areas and the cornu ammonis. Numerous ganglion cells of the cortex show Alzheimer's neurofibrillary change. General increase of glial elements in the cortex, and diffuse reduction of ganglion cells. The vessels are normal. Pituitary: There is a large squamous-celled area replacing a large part of the pars tuberalis. The anterior lobe is normal. *Other organs:* Heart, normal; a little atheroma at the bifurcation of the aorta. Purulent bronchitis and bronchiolitis. Remaining organs normal. The microscopical findings are in accordance with the naked-eye appearances.

CASE 3.—Mrs. C. F—, aged 53. Admitted on 9.xii.1931. *Family history:* Negative. *Personal history:* The patient has been physically healthy, apart from a mild diabetes which was discovered several years previously. She has always been very conscientious and of an apprehensive and worrying nature. She had to give up her post as a combined nurse and maid on account of her illness in June, 1929. Since then she had shown a progressive mental deterioration with increasing failure of memory; she could not look after herself and became very restless, especially at night. At times she has been very distressed and irritable. During the last two years she has been unable to read and recently she has become extremely restless and confused. She has lost count of time and place. No history of fits.

Behaviour on admission.—The patient does not know her age and cannot recall where she lived. She is apt to become irritable whenever she is unable to answer a question. She has no insight and says her memory is quite good; on occasions she says vaguely that she suffers from nerves. There are no signs of aphasia on admission. *Physical examination:* Well nourished woman with fresh complexion. Cardiovascular, respiratory, alimentary systems normal. B.P. 140/100. Neurological examination reveals abnormal reflexes. Knee and ankle jerks exaggerated left side, plantar extension on left and sometimes on the right side; no paralysis, otherwise nothing abnormal. Urine, blood and C.F.S. negative. 10.i.32: Disorientated for time and place. Gross memory defect of the organic type. At times she appears confused and loses herself in the ward. Marked emotional instability. Laughter frequently gives place to tears. 7.iii.32: Working in ward and laundry. Sent to a Poor Law Institution. 24.ii.33: Readmission 14 days previously on her becoming confused and restless. She had had two major epileptic fits during the last month. On admission extremely agitated and confused; most of the questions put to her are ignored and she struggles constantly to get home, exhibiting the picture of extreme mental distress. 25.ii.33: Three major epileptic fits. No aura. 15.iii.33: She wanders about the garden restlessly the whole day, does not want to stay in bed, is tearful and distressed at times. Simple questions would elicit tears. Her answers are either very short or she would say that she did not know. She sleeps well and eats enormous quantities of food. 15.v.33: No change. She has periods of intense agitation. 9.xi.33: Major epileptic fit, the convulsions affecting the right half of the body more than the left. 30.xi.33: Condition unchanged. The patient keeps on wandering about restlessly the whole day and becomes resistive if one tries to stop her. Only occasionally is it possible to carry out a conversation with her. She is apt to evade and to dodge questions which she is unable to answer and gets irritable and even aggressive when pressed. Specimen of conversation. (How are you?) "Oh well, some days I am better than others." (How are you to-day?) "Well I have been . . . I had this . . . one of they things . . . it was with that." (What date is this?) "I am not going to the calendar." (Tell me the month of the year.)" I don't bother about months." (Can you mention any month to me?) "It's not easy to be shoved into things like that." (Show me your tongue) "Oh, I can do that right enough." (Hold up you right hand.) "I'm never asked to do such things" (holds up left hand). The majority of objects shown to her are named correctly; only occasionally she uses a wrong word, e.g. she calls a pen a clock. Whenever she finds it difficult to answer a question she becomes argumentative and irritable. "What right have you to ask these questions?" "These questions will not help me," etc. 15.xii.35: Unchanged. The patient is constantly on the move, wandering about the whole day and liable to extreme fury if frustrated in any way. Once in two or three months she has a major epileptic fit, following on which she is in a state of great excitement and attacks the nurses and those about her. 10.vi.37: The patient is going downhill physically and has become extremely emaciated. She is still restless at times, and has fallen out of bed. She has occasional major epileptic fits. 13.x.37: Died after repeated haematemeses.

Post-mortem examination (Dr. A. C. P. Campbell).—*Brain:* Marked generalized atrophy, most pronounced in superior parietal lobule on each side; dura, leptomeninges and basal arteries normal. Microscopically: Sections from frontal (area 10), occipital (area 17 and 18), insular and hippocampal cortex show many argentophile plaques, distributed through all the cortical layers and most numerous in the occipital cortex. Numerous ganglion cells show

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Alzheimer's neurofibrillary change, present in all layers though most prominent among the pyramids of the third. The cornu ammonis shows a good deal of neurofibrillary change but not very numerous plaques. There is the usual proliferation of glial elements in all these cortical regions. The gross cellular architecture shows no obvious change, but there is a diffuse reduction of ganglion cells, affecting especially the third and fifth layers. The basal ganglia show nothing abnormal; there is shrinkage, rarefaction and moderate gliosis around some of the vessels in the putamen. The vessels themselves, here and elsewhere, appear normal. Pituitary normal. *Other organs:* Lungs—miliary tubercles and signs of chronic phthisis. Tuberculous ulcer about the jejuno-ileal junction. Hyalinizing arterio-sclerosis of the spleen. Acute haemorrhagic pancreatitis with fat necrosis. Remaining organs normal. Microscopical findings were in accordance with the naked-eye appearances.

CASE 4.—Miss H. M—. aged 56, admitted on 9.vi.1941. *Family history:* Negative. *Personal history:* Nothing is known about her childhood. She was of a happy disposition, a good mixer, always gay and cheerful. She was a buyer and was very capable. She kept herself and her mother, to whom she was unduly attached. Eight years previous to admission her mother died; the patient had nursed her for the last eight months of her illness. After the death of her mother the patient became very nervous and depressed and would not sleep alone; a friend went every night to sleep with her. This continued till, five years later, the friend became ill and slept at her own home; the patient became very upset and transferred herself to her friend's house. She was at that time strange in her manner, her memory had gone, she hardly spoke, sat about the house, showed no interest in her surroundings and appeared to be depressed. She often would accuse her friend of having taken things she had mislaid; when they were shown to her she cried and sobbed. She followed her friend about like a child. She has become very difficult and sometimes has refused to eat. Two weeks before admission she said she wanted to cut her throat. During the last six months a slight loss of power of the right extremities has been noticed and she has not been able to speak correctly.

Behaviour on admission.—The patient smiles vacantly. When asked how she is she says: "I am feeling better." When shown objects such as a key and asked what it is she says: "It's a, it's a, h-h, m-m, sh, sh, chop," or some other word equally removed from the real name. When asked to hold it as she would when using it she takes it, turns it aimlessly around and does not appear to recognize it. Asked what day it is, she looks blank and then, after a long time, says, "I forget—I don't know—is it winter?" She does not seem to know where she is and has no interest in her surroundings. She does not talk in response to questions. Her speech usually consists of the loose and incoherent attachment of syllables to each other. She utters them in an iterative fashion, repeating the same sound or syllable three or four times. There is marked echolalia. Under emotional stress she would utter words but never phrases: e.g. during lumbar puncture she said, "Oh, sore," and the word "damage" was also heard repeatedly. *Physical examination:* The patient is very obese. No abnormality of the circulatory system. B.P. 126/86. Neurological examination difficult owing to lack of co-operation. There was a right hemiparesis, most marked in the face and upper extremities; hypertonus over the right extremities; tendon reflexes brisk both sides, no clonus. Plantar response flexor both sides. Gordon's reflex strongly positive both sides. Oppenheim slightly positive both sides. Abdominal reflexes present. Reaction to pain normal. C.S.F. normal. *Encephalography:* Marked general enlargement of the ventricular system including the third ventricle, without displacement. Very gross enlargement of the subarachnoid fluid spaces over both frontal regions and enormous dilatation of the fluid spaces of the Sylvian fissure. 13.vii.41: The patient died from bronchopneumonia.

Post-mortem examination (Dr. W. Blackwood).—*Brain:* Marked diffuse gyral atrophy. Pia arachnoid and basal vessels healthy. Moderate degree of ventricular dilatation. *Microscopically:* Diffuse reduction of ganglion cells especially in the third and fifth layer, most marked in the frontal insular and hippocampal areas; very numerous argyrophile plaques, most abundant in the frontal and occipital areas and very numerous in the insular cortex, hippocampus, cornu ammonis and motor cortex. Copious plaques in the claustrum and a fair number in the putamen of both sides, but none in the cerebellum and the pons. There are numerous cortical cells with Alzheimer's neurofibrillary change in the cortex, especially in the cornu ammonis. There is the usual glia reaction around the plaques and diffuse over the cortex. The vessels of the brain do not show any abnormality, apart from a slight increase of adventitial tissue in the wall of the pial vessels. *Other organs:* Acute bronchiolitis and bronchopneumonia. Heart flabby, otherwise healthy; slight atheroma of the aorta. Cholesterol stone in the gall-bladder. Septic spleen. Remaining organs healthy. The microscopic findings are in accordance with the naked-eye appearances.

CASE 5.—Miss J. C—, aged 66, admitted 4.xi.1937. *Family history:* Negative. *Personal history:* The birth of the patient was premature, at seven months, and she was very delicate as a baby, could not walk until she was 4½, but is said to have talked and teethed at the usual times. During the first six years of her life she had typical epileptic fits. She was always self-centred and selfish. She did not make friends; was secretive in her personal affairs and of a suspicious nature; she was stubborn, but never bad-tempered or depressed. She was intelligent, hard-working, conscientious, painfully clean; she had no hobbies beyond cleaning. Until 1926

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she helped her mother in running a hotel; she lived with her mother until the latter died in 1930. When the patient was about 60 it was noticed that she had become peculiar, but as she lived on her own and met hardly anybody her mental change may have set in much earlier. She neglected herself and her house, had become very suspicious, thought people were coming into her house stealing. Her memory was failing. She would wander about aimlessly and recognize strangers as old friends. She used to collect eatables and accused others of having stolen them. She spoke to herself a good deal. "Her principal occupation at home has been to sit in front of the mirror and talk to her reflection in a confused manner." Sometimes she spoke to imaginary faces. She cannot always find the correct word for things and has no idea of time and person. She has never complained of physical discomfort. Lately she has been getting very thin. For two years previous to admission she has been unable to dress herself and she could feed herself only if everything was cut up for her. Her sleep has not been disturbed. Five days before admission she had a typical major epileptic fit. Since then her speech has become worse.

Behaviour on admission.—The patient is restless and sometimes noisy and resistive. She takes her food quite well and sleeps well. She is incontinent of urine. There is no obvious lability of affect and she is pleasant and smiling in her manner. On the whole her mood is that of a mild euphoria. She speaks rather indistinctly. Her answers frequently show complete incomprehension. Specimen of conversation: (How old are you?) "I don't think you are." (How do you feel?) "In what sense, if you know anything about it." (What is your name?) "Miss C—" (correct). (What is your full name?) "Let me see, it's just that . . . . water colours." (What year were you born in?) "Oh, yes, you have to take that out, haven't you . . . see what you are doing . . . it would be." (Capital of Scotland?) "Vert rel . . . tic, tic, tic." Naming of objects: (Cigarette-case) "Oh, but that's a bonny wee thing." (Matchbox) "Empty glass." (Keys) "These were the last ones we had, scissors." Asked to write her name she writes the M, but does not get any further, mumbling away to herself, and playing with the pencil. Asked to read the time she said 1 o'clock for 12 o'clock. Asked to carry out simple commands she fails to do so. There is some suggestion of confabulation. She would say she had been out the foregoing day, etc. She says her mother is still alive. *Physical examination:* Neurological examination difficult owing to resistiveness, but there are no signs of a localized lesion. Radial artery slightly sclerosed. Occasional extrasystoles over the heart which is slightly enlarged to the left. B.P. 130/80. W.R. in blood and C.S.F. negative. Urine normal. 20.xii.37: No change in the condition. 27.xii.37: The patient died as a result of a cellulitis developing from bed-sores.

Post-mortem examination (Prof. Drennan).—*Brain:* There are a few adhesions of dura and pia arachnoid over the frontal region. Generalized gyral atrophy. Atheroma of vessels at base. *Microscopically:* Sections of cortex, polar, frontal, occipital, insular, cornu ammonis show numerous argyrophile plaques in all these areas; they are diffusely and evenly distributed over all cortical layers. Many ganglion cells (especially the smaller pyramids of the 3rd and 5th layers) in all these regions show Alzheimer's fibrillary change. Cajal's gold impregnation shows the usual proliferation of the glia throughout the cortex. Occasional cortical arterioles show light thickening and hyalinization of their walls. There are, however, no focal necroses or ganglion cell removals and only occasionally a small area of perivascular gliosis is seen. No plaques or neurofibrillary change in the basal ganglia. No vascular changes were seen here or in pons or medulla and no damage to parenchyma apart from a moderate generalized lipofuscin deposition and a diffuse reduction of nerve cells in the cortex. Pituitary normal. *Other organs:* Marked congestion of the lungs. Heart atrophic; moderate atheroma of coronary arteries; atheroma of abdominal aorta. Cloudy swelling of the kidneys. Thyroid markedly atrophic. Remaining organs healthy. Microscopically: Brown atrophy of the heart with moderate fatty infiltration of ventricular myocardium; hyalinizing arteriosclerosis of the kidneys; slight fibrosis of the thyroids.

CASE 6.—Mrs. B. F—, aged 59, admitted on 12.vi.32. *Family history:* Negative. *Personal history:* Normal childhood development. The patient had a very happy nature; was a good mixer. She has suffered from hay fever and attacks of migraine all her life. At one time she had what seemed to be a great thick cord between the eyes which nearly closed one eye; it went after a few days (angioneurotic oedema?); otherwise she was healthy until at the age of 39 she had a fit during the night. Some years previous to admission she had a similar attack, after which she gabbled incoherently for some minutes. The description of both attacks is suggestive of major epileptic fits. About three years previous to admission she began to lose her memory; she forgot to do things; spoke only of her younger days. She played eternally in the coal-house, piling the coal up and then taking it down without purpose; bought things from every traveller who came to the door; forgot how to cook and recently she had been incapable of doing anything; was restless and always wanted to be on the move. She forgot what she was speaking about and never finished a tale, repeating the same thing over and over again. The last year she had been much worse. She imagined that she was employed by the Broadcasting Corporation and danced in front of the wireless. She complained that she had not been paid for her services. She used to wake through the night and say she saw people approaching her; she once said she saw a man looking at her through the window. Recently she heard voices speaking to her. She had not been depressed but she would laugh and cry

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without reason; there had always been a flood of tears when a certain tune was played and she laughed when a railway whistle went off. Some weeks previous to admission she became very excited, danced and shouted in front of the wireless. She went out carrying a little case full of rubbish, returned in an exhausted condition two hours later and lay down to sleep; when she woke up she became aggressive against her daughter. The following day she again wandered away. She was looking exhausted and distressed and spoke of doing something to herself.

Behaviour on admission.—The patient is clean and tidy, and has usually a smiling and contented expression. Her behaviour indicates a lack of comprehension of her surroundings. She wanders about and sometimes walks into another ward, where she opens a conversation with someone quite strange to her. Her speech is frequently quite incoherent. "I sew and scrub and it was my aunt that told me to go. I can walk and I can bake—have a good pair of hands and I can be very . . enjoy if I could get it . . I am just sort of . . ." Asked to name objects she usually does so fairly well, but often she gives only approximate answers; "pencil" for pen, "wood" for locker, "cloth" for screen. She is inclined to repeat her answers over and over again. Occasionally confabulation occurs. She often speaks about her imaginary connection with the B.B.C., but no definite hallucinations can be elicited. Memory and retention are gravely impaired. The patient seems to be vaguely aware of her deficiency. *Physical examination:* Slight enlargement of the heart to the left. B.P. 210/100, but there is no evidence of peripheral arteriosclerosis. Alimentary, respiratory, genito-urinary systems normal. Neurological examination negative. The patient stayed in hospital for more than two years, and died on 17.viii.39. Until a few months before her death her condition had been the same as at the time of admission. She used to be restless but not difficult. She was usually pleasant and apparently contented. She became increasingly emaciated and died from bronchopneumonia.

Post mortem examination (Dr. W. Blackwood).—*Brain:* Diffuse gyral atrophy, more marked over the frontal lobe. Slight opacity of basal vessels; no evidence of vascular damage. Marked ventricular dilatation. *Microscopically* the vessels are found to be generally healthy. The arterioles show no hyaline changes. No perivascular gliosis except in one or two areas of the putamen. Many argyrophile plaques in the frontal, motor, occipital, insular and hippocampal cortex and in the putamen. There is a small number of cells with Alzheimer's neurofibrillary changes in the cortical areas. *Pituitary:* The anterior lobe shows an excess of basophil cells. The posterior lobe near the stalk shows a small area of haemorrhage and occasional deposits of haemosiderin, evidently resulting from small haemorrhages. *Other organs:* Left basal bronchopneumonia. Heart small with hypertrophy of left ventricle. Sclerosis of the medium sized arteries in the kidneys; the appearances are those of a kidney with a hypertensive blood supply, but the arteriolar changes are not those of hypertension of renal origin. Congestion and arteriolar hyalinization in the spleen. The other organs examined, both macroscopically and microscopically, are found to be healthy.

CASE 7.—P. G—, aged 61. Inspector of tram company; admitted on 18.ii.42. *Family history:* Negative. *Personal history:* The patient has always been a quiet, easy-going, home-loving man who lived in his work; "he was a teetotaller." He had been a tram conductor and inspector since 1909. 8½ years previous to admission he was knocked down by a lorry, was taken to hospital unconscious, recovered consciousness within an hour; he was three months off work after the accident. On 6.xi.39 he was again knocked down unconscious by a tram car; he regained consciousness after an hour. Since then he had been markedly different; he was irritable, easily exasperated, worried a good deal about unimportant matters. He returned to his work at the beginning of 1940. On 9.iii.40 he met with another accident; he fell off a tram car. His right eye was cut. He was not unconscious. He was later found wandering about the town. He was dazed and unable to say what had happened. He had been off work ever since and had remained at home, helping about the house. Since the last accident he had suffered from violent headaches and used to wander in conversation. Since December, 1941, he had misidentified members of his family. He had become very restless, but not violent. Informant stressed his abnormal appetite. He had been passing urine just anywhere he happened to be, but had not lost his sense of shame. During the last month before admission he had been speaking to his own image in the mirror continuously. He had been imagining himself at his work; he whistled with his mouth to move the trams on and talked about them a lot. He saw "tons of people" in his room—these were "his public" whom it was his duty to show to their tram. He said they were upsetting his bed.

Behaviour on admission.—The patient is very restless; it is difficult to keep him in bed; he wanders about in the ward. He is disorientated for time and place; gross impairment of memory and retention. He appears to be quite contented. When in bed he constantly fumbles at the bed-clothes and his sleeves, going through stereotyped movements involving twisting and untwisting them over and over again. No gross disorder of speech, apart from difficulty in naming objects. When shown a key he grasps at it; asked what it is he says "a dog" and later "for opening the door, key, key." At other times he names objects correctly without hesitation. He is unable to read aloud, though he appears to understand what is required from him in writing. When the paper is given to him upside down he turns it the right way up. With great difficulty he can sign his name when asked to do so, but he cannot say what he has written and he cannot write more. *Physical examination:* Cardiovascular and other systems healthy.

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B.P. 140/80. W.R. in blood negative. No signs of injury to the skull. Neurological examination negative. 10.iii.42: The patient is restless, wandering about the ward day and night; several times he tried to get into another bed that happened to be at hand. His mood is that of a mild euphoria, and he often is found to be under the impression that he is giving tram tickets to imaginary people, muttering to himself incoherently; all his spontaneous conversation is about trams. When shown to the students in the lecture theatre he said that he saw tramlines in front of him. He goes through all the motions of examining imaginary tickets and of showing people on to trams. 18.iii.42: The patient has become weak and helpless and has to be spoon fed—he is incontinent. During the whole day he is exhibiting stereotyped movements with his hands and fingers, twisting and untwisting corners of the bed sheets and pulling his shirt over his head again and again. He has become quite inaccessible; he can no longer speak intelligible words and he makes sounds resembling baby talk. He cannot understand what is said to him. The neurological examination does not reveal any change. The patient died on 27.iii.1942. During the last weeks he had developed trophic ulcers resulting in multiple abscesses.

Post-mortem examination (Dr. Blackwood).—*Brain:* Dura over the vault was diffusely thicker than normal; its deep surface has a slight brownish discoloration and appeared to be more vascularized than normal. On the right side there is an organized and quiescent subdural haematoma of minimal thickness. Pia arachnoid and basal vessels normal. Diffuse gyral atrophy. Moderate internal hydrocephalus. *Microscopically:* Diffuse atrophy with reduction of ganglion cells, affecting especially the third and fifth layers, lipodystrophy, numerous argyrophile plaques and many cells with Alzheimer's neurofibrillary change, the latter being found especially in the small and medium-sized pyramidal cells. Slight thickening and hyalinization of cortical arterioles but no vascular lesions. *Other organs:* Brown atrophy of the heart, congested lungs, nutmeg liver, congested spleen and kidneys. The aorta and carotid arteries showed a minimal amount of arteriosclerosis. The microscopical findings in the organs are in accordance with the naked-eye appearances.

CASE 8.—Miss J. C. S—, aged 75. Admitted on 10.xi.30. The history of her past life is scanty. Gross failing of memory was noticed at the age of 55; she has not been out of the house for the last 20 years, spending most of the time wandering about her room restlessly. On many occasions she has burned articles of furniture. She thought she was looking after her sister, who died many years ago. When the household was broken up the patient had to be taken to hospital.

Behaviour on admission.—The patient smiled, shook hands with everybody and replied to questions with unintelligible mutterings. She picks spasmodically at the bedclothes. Her replies are quite irrelevant to the questions and consist of simple sentences such as: "Look at her; there is a flower; who are you?" etc. She is disorientated for time and place. Her mood appears to be one of contentment. She is apt to be annoyed by attention and occasionally slaps the nurses. Sometimes she will jump out of bed and run round the room muttering and smiling. She sleeps well at night, takes her food well and is clean in her habits. No fits. *Physical examination:* Frail, emaciated woman. Reflexes normal. No motor disturbance, apart from slight tremor of the hands; otherwise no sign of Parkinsonism. Heart sounds pure and regular. 15.i.30: Condition unchanged. The patient seems happy and has no insight into her condition. 15.iii.1932: Died under signs of uraemia.

Post-mortem examination (Prof. Biggart).—*Brain:* Generalized gyral atrophy. Only slight atheroma of the basal arteries. *Microscopically:* Diffuse cortical atrophy, most apparent in the three outer layers of the cortex, with marked reduction of ganglion cells; the remaining cells show chronic degenerative changes—vacuolization, shrinking and Alzheimer's neurofibrillary change. Numerous argyrophile plaques in all laminae. Marked glial reaction, especially around the plaques. The changes are evenly distributed over the cortex. No marked changes in the vascular system; the walls of the arteries are somewhat thickened and the larger vessels show a slight degree of atheroma. Pituitary: Increase in vacuolated basophiles. *Other organs:* Heart atrophic with chronic interstitial myocarditis. Atheroma of abdominal aorta. Terminal bronchopneumonia. Old infarction of the spleen. Moderate fatty degeneration of the liver. Congenital cystic pancreas. Papillary adenocarcinoma of the bladder; cystitis; hydroureters; hydronephrosis. The kidneys are composed of large cysts which do not communicate with the pelvis (congenital cystic kidney). The microscopical findings are in keeping with the naked-eye appearances.

CASE 9.—Mr. G. I. B—, aged 73, admitted on 3.viii.1940. *Family history:* Both parents died when the patient was an infant; cause of death unknown; both were said to be highly strung. There were two brothers; one died of septicaemia, the other of cerebral haemorrhage at the age of 55. The patient has three healthy children.

Personal history.—Normal childhood; brilliant at school. When he was 20 he had writer's cramp which necessitated his going off work for 1½ years. After this he went for a sea voyage round the world; when he returned he had recovered. He had always been irritable and touchy, overstrict in bringing up his children. "His daughters found him terrible and it was through his insufferable behaviour that they determined never to marry." He had always a tendency to overwork. Never drank excessively. When he was about 60 his memory began to fail, he became increasingly irritable and restless, often threatened to strike his wife, and once became

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actively aggressive. He put his son out of the house, insisting that he had banged a door to annoy him. He used to hide things away. He often got up at night and dressed himself fully, and he would get very cross when anybody interfered. His habits became faulty and he lost every sense of shame. He used to speak to himself in front of the mirror for hours. He became extravagant, giving away pound notes for no reason. For the last three years previous to admission he had not recognized his wife.

Behaviour on admission.—He is extremely restless. He does not answer any questions. He says: "Boop, boop, boop," all day long. At the same time he rocks his body all day. *Physical examination:* The patient is emaciated and has bedsores. Incontinence of urine and faeces. Heart slightly enlarged; ringing second aortic sound; pulse-rate 60; no signs of peripheral arterio-sclerosis. B.P. 220/110. Respiratory and alimentary systems healthy. Neurological examinations: Cranial nerves normal. Spontaneous movements, see above. Flexion contractures of both knees. Knee and ankle jerks increased both sides, ankle clonus both sides. Babinski and Oppenheim negative. Urine normal. 24.xii.40: The patient has been very restless all the time, getting out of bed and falling about. He died from bronchopneumonia.

Post-mortem report (Dr. W. Blackwood).—*Brain:* Dura healthy. Pia arachnoid showed slight opacity over the vertex. Marked external hydrocephalus. Marked generalized gyral atrophy, especially in the frontal region. Patchy atheroma of basal vessels. Symmetrical, ventricular dilatation. *Microscopically:* Numerous argyrophile plaques in the frontal cortex and a small number of cells with Alzheimer's neurofibrillary changes. Diffuse reduction of ganglion cells especially in the third and fifth layers. The blood vessels in the brain tissue are normal; no perivascular changes. *Other organs:* Right bronchopneumonia. Heart slightly enlarged. Old subepicardial fibrosis at the apex of the left ventricle; coronary vessels straight with moderate atheroma; atheroma of the abdominal aorta. Cholesterol stone in the gall-bladder, otherwise alimentary system healthy. Hydronephrosis. Enlargement of the prostate. The microscopic findings are in accordance with the naked-eye appearances.

Summary of the findings in Cases 1 to 9.—It is proposed to summarize the observations collectively in the order of certain relevant points.

Heredity.—The case material does not contain any conclusive contribution to the problem of heredity in Alzheimer's disease. Certain data may be of interest. The father of Case 2 had committed suicide and a brother apparently became demented later in life; it could not be ascertained whether he suffered from a presenile dementia. A brother of Case 9 died of cerebral haemorrhage. The father of Case 1 died of cancer. The latter fact deserves mentioning, as cancer occurring in the patients themselves or in their families has been reported by other writers in a considerable number of cases. In this case material only one (Case 8) died from cancer.

Sex incidence.—Seven of the 9 cases were females; 4 of the 7 women had borne children. The case material of several other authors showed a similar prevalence of the female sex.

Congenital abnormalities and previous illnesses.—Case 5 was born prematurely and had epileptic fits during childhood; she had one major epileptic fit in the course of Alzheimer's disease. Congenital cystic pancreas and kidneys were found in Case 8, who died from cancer of the bladder. Case 6 suffered from allergic reactions (angioneurotic oedema with migraine). In Case 3 diabetes mellitus developed some years before Alzheimer's disease. In none of the cases could a relationship between extracerebral physical illness and Alzheimer's disease be conclusively established.

Previous personality.—Cases 1, 2, 4 and 7 were described as having been of a syntonic disposition; of these, Cases 1 and 2 had shown a tendency to depressions. There had been obsessional neurotic personality trends in Case 5. Case 9 had suffered from writer's cramp when he was 20. The previous personalities of those two cases had shown schizoid features with inclination to a paranoid attitude. It is of interest that in the same two cases (5 and 9) paranoid symptoms became obvious in the course of the illness, while the emotional reactions during Alzheimer's disease in the cases with syntonic temperament were in keeping with that type of emotional make-up.

Age of onset and duration of illness.—Owing to the insidious nature of the onset in all the cases presented no definite statement can be made as to the age of onset. It can be assumed that, with two exceptions, the mental change was noticed only when there was gross impairment. Considering the fact that in females who are not doing skilled professional work slowly progressive mental deterioration is usually noticed only when it is well advanced, it can be assumed that careful psychological examination would have established signs of intellectual impairment long

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before it became obvious enough to be taken seriously by the relatives. In addition, it must be taken into account that in late middle life a certain amount of failing in the intellectual and emotional functions is usually passed over as being within the range of physiological involution. The two exceptions mentioned above are Case 6, whose first epileptic fit at the age of 39 can, retrospectively, be regarded as the first sign of Alzheimer's disease, and Case 7, whose first accident at the age of 52 was obviously due to an epileptic attack. Both cases had similar attacks later in the course of their illness. Careful examination would have revealed general mental change at the time of the first fits, while the relatives noticed them only much later and the patients were able to carry on with their routine work for some years longer. With the above-mentioned limitations in mind the ages of onset of Alzheimer's disease can be assessed as follows: Case 1, 52 (duration 5 years); Case 2, 51 (11); Case 3, 51 (10); Case 4, 48 (8); Case 5, 60 (6); Case 6, 39 (15); Case 7, 52 (10); Case 8, 55 (20); Case 9, 60 (13). Only in one case therefore the first signs of Alzheimer's disease were noticed in the fourth decade of life, while in the rest the illness appears to have developed in the age-period of between 50 and 60.

Course and development of the illness.—In Cases 6 and 7 the first symptoms had been an epileptic attack, after which it took some years until gross mental change was noticed. Further fits occurred in those cases after a period of several years, in Case 7 each being followed by rapid mental deterioration. In Case 1 the progress of the illness, which had been slow before, became more rapid after the first epileptic fit. In the remaining cases the development was gradually progressive. There were no remissions in any case, though a stable environment occasionally appeared to result in an improvement of behaviour.

Subjective complaints.—In Cases 4 and 7 depressions with anxiety and irritability appeared in the early stages of the illness. Only Cases 3 and 4 occasionally expressed insight into their deficiencies. The majority of cases, however, gave the impression of being vaguely aware of the fact that they were going downhill, and this may have been partly responsible for the distress which they often exhibited. Case 2 complained of spasmodic headaches during the first years of her illness and so did Case 7. In the latter case the headaches may have been caused by accidents which had resulted in head injuries.

Epileptic fits.—In the histories of 5 out of 9 patients (Cases 1, 3, 5, 6, 7) there had been isolated epileptic fits, or seizures strongly suggestive of such fits. In Case 7 epileptic attacks were obviously responsible for accidents. Only in Case 3 there was a greater number of epileptic fits, which used to occur in series when the illness was well advanced. In the other cases the fits did not occur in the advanced stages of the illness. In none of the cases were minor epileptic fits observed.

Special psychotic features; hallucinations and delusions; delirium.—In Cases 1 and 5, auditory, in Case 6, auditory was well as visual hallucinations were observed during the first years of illness. The hallucinations in Case 6 were connected with expansive delusions. Only in Case 5 the contents of the hallucinations were reminiscent of those usually found in senile dementia. Paranoid features were obvious in Cases 3 and 6. Case 3 was paranoid and depressed and showed a tendency to self-accusations. Case 3, who had epileptic fits, sometimes exhibited features reminiscent of the epileptic personality change. Case 2 showed a typical hypomanic mood.

The overactivity common to all patients took the form of occupational delirium in Cases 2 and 7; the imaginary occupation was the one to which they had been most strongly attached prior to their illness.

An unusual kind of delirant behaviour was seen in four cases (4, 5, 7 and 9). They were observed to spend many hours before the mirror speaking to themselves. In all those cases that symptom had been so persistent and conspicuous that the relatives regarded it as the strangest feature in the behaviour of the patients.

Memory and retention.—All cases exhibited the typical organic amnesic syndrome when they came under observation; in all patients orientation in time and place had completely gone; the orientation as to their own identity did not seem to be greatly affected. Those whose power of expression was not too gravely impaired showed typical confabulation. Misidentification of persons of their environment was not uncommon.

Neurological signs and symptoms.—Taking into consideration the epileptic fits,

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in none of the cases were signs of cerebral lesions lacking. In Cases 5, 6 and 7 fits were the only signs. Case 2 developed a left-sided paresis of pyramidal type in the last month before death; Case 4 a slight hemiplegia of a permanent character eight months before death. No gross localized lesions were found anatomically in those cases. The increase of reflexes developing in Case 1 a few days before death was found to be due to a subdural haematoma. In Case 3 there were pyramidal signs without paresis on one side. Motor symptoms suggestive of extrapyramidal origin were present in Case 8 (slight tremor of the hands) and Case 9 (stereotyped rocking movements). The latter case developed a flexion contracture of the legs with increased reflexes towards the end. Morbid hunger was observed as a transient symptom in Cases 3 and 7.

Cardiovascular system.—The blood pressure was abnormally high only in Cases 6 and 9, but there were no other clinical signs of arteriosclerosis in those two cases, nor were their histories suggestive of cerebral arteriosclerosis. None of the other cases showed such signs. Subdural haematomata occurred in two patients with normal blood pressure.

General behaviour.—General or partial overactivity of some degree was a characteristic feature of the behaviour of all cases. It was not confined to any special stage of the illness. In the majority it was noticed at the same time as the impairment of memory, and it remained a consistent feature until progressive emaciation completely incapacitated the patient. It usually took the form of a general restlessness driving the patient to wander about, or to perform the same act over and over again in a manner sometimes reminiscent of the iterative behaviour of obsessive compulsive neurotics or of the overactivity of hypomanic patients. Certain features of their speech (see below) appeared to be due to the same basic tendency. In some cases the hyperactivity at first expressed itself in their daily work and had a purposeful character, though the feature of senseless repetition and stereotypy soon became obvious. Later it would be turned into stereotyped movements of a more primitive nature, but even then a certain tendency to make them appear purposeful—rationalize them, so to speak—was obvious. Only in one patient (Case 9) the mass movements observed in the late stage of the illness were devoid of any such tendency. It cannot be excluded that the over-appetite exhibited by two cases (3 and 7) was an expression of overactivity rather than of metabolic disturbance. The occupational deliria observed in Cases 2 and 7 have been referred to above; they present illustrative instances of stereotyped and repetitive behaviour. Both patients had chosen activities from their previous occupations (rocking the baby, issuing tram tickets) which lent themselves well to the satisfaction of an urge towards stereotyped repetition. In this case-material the restlessness was not confined to the night time. The majority of the patients slept well and typical inversion of sleep was not observed. In those cases which were subject to epileptic fits the restlessness and irritability occasionally increased for some time after an attack. Many features in the behaviour of the patients can be suitably described as resulting from a retrogression to an infantile level. This applies particularly to those features which originated from abnormal emotional reactions.

Emotional reactions.—In two cases (4 and 7) there had been a period of initial depression. In other cases short periods of depression were not uncommon throughout the illness. Cases 4 and 6 occasionally made suicidal remarks. As a rule there was extreme emotional instability on the background of euphoria or distress. Only Case 2, whose temperament prior to the illness was described as depressive, was consistently euphoric and even hypomaniacal. Case 4, on the other hand, who was said always to have been happy and cheerful, exhibited a mood of depression. In three patients (Cases 1, 3 and 6) compulsive crying and laughing were observed occurring as responses to outward stimuli, trivial questions would elicit tears or laughter. Increased irritability was a common feature, and in some cases it was obviously related to the sense of inability to deal with a situation or a task. On such occasions the patients would exhibit signs of distress or refuse co-operation, the latter attitude sometimes resulting in a behaviour reminiscent of negativism. Expressions of distress of varying degree were frequent, and the patients often seemed to suffer from a feeling of apprehension and tension which they tried to overcome in some way. In the advanced stage of the illness the patients did not show signs of fear of their environment. It is very likely, however, that this had been the case during the earlier stages, especially in those cases which

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developed paranoid ideas. The patients took hardly any interest in what was going on around them, but this was obviously not due to general indifference, but to the fact that they were absorbed in their own drives and were incapable of turning them into constructive activities. They were, as a rule, not difficult to contact. Their relationship to those around them was that of dependence, and they relied on their environment for help in satisfying their primitive needs. None of the patients retired into an attitude of indifference or exhibited complete lack of initiative. Even during the latest stages of their illness they showed some initiative by producing speech, however deficient.

Speech.—In all cases of this series the illness was well advanced when the patients came under hospital treatment and their speech was considerably affected. Their powers of expression as well as of comprehension were disturbed in varying degrees. Some of them were, at that stage, still able to express themselves and understand simple questions and commands. If the subjects of conversation were without a concrete interest for them they were more apt to fail and withdraw than otherwise. When spoken to they usually produced a flow of words, but their sentences frequently showed grammatical mistakes, were often incomplete and, as a rule, poor in substantives. Neologisms of the type produced in a typical nominal (auditory) aphasia were extremely rare, but the patients frequently mixed up substantives. In the more advanced stage of the speech disorder, when asked to name objects they very often did not produce words associated with the objects in question, e.g. a key would be called a " dog " or a " chop," etc. In their spontaneous utterances, too, they often seemed to associate freely in conversation, guided by external stimuli, auditory or visual, and clang associations. They were inclined to produce simple automatized sequences, e.g. a watch would be called " 1, 2, 3," obviously under the visual impression of the figures of the dial. There sometimes appeared a tendency to rhyming. Those features were reminiscent of flight of ideas. Echolalia was common. The tendency towards stereotyped iteration expressed itself either in an " automatic " repetition of the last words of a sentence spoken by them (palilalia) or by an iterative repeating of distorted parts of words (logoclonia). Commands referring to parts of their own bodies were on various occasions carried out much better than others unconnected with the ego of the patient; in some instances the patients named parts of their own bodies correctly while unable to name other objects. Sometimes a tendency to relate external objects to themselves was observed; the patient would call an object his own, and it seemed as if by thus taking possession of the object he facilitated the finding of the correct name. Occasionally there was a tendency to use frequently adjectives expressing an emotional attachment, such as " nice," " beautiful," etc. Towards the end of the illness the utterances became more and more primitive and amorphous. No sentences were formed and logoclonia, palilalia, echolalia and automatized sequences were prevalent. The articulation deteriorated and the speech became slurring and monotonous. Writing and reading invariably appeared to be affected more severely and earlier than speaking. At a stage in which the patients were capable of forming sentences they could not more than scribble. Their disinclination to write was obvious.

Some degree of *apractic disorder* could be observed in all patients in the more advanced stages. As usual, the primitive functions, such as taking food, were affected later than the others. Often it was impossible to decide whether failure to carry out certain actions was due to an apractic, aphasic or even agnostic disorder and it appeared to be the result of a more general deficiency.

Anatomical findings in the brain.—In all cases there was advanced symmetrical generalized gyral atrophy; in some the atrophy was more marked in certain areas; in Case 2 the frontal, in Case 3 the parietal regions were more affected than the others. The higher degree of atrophy of certain parts of the cortex was not clearly associated with a specific symptomatology. Cases 8 and 9, in whom the clinical symptoms set in comparatively late and who died in senium, showed a diffuse atrophy without local increase. The distribution of the plaques was typical in all cases; they were less numerous in the central gyri which, as a rule, were less affected by the atrophying process. There was no strict relationship between the number of plaques, and the degree of atrophy, the duration of illness or the age of the patient. The number of cells with Alzheimer's fibrillary change varied and did not correspond to the number of plaques; in two cases such cells were scanty,

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though plaques were abundant. In some cases plaques were found in the subcortical white matter and in the striate bodies. In none of the cases were there lesions of vascular origin in the brain substance; in some the big vessels at the base showed atheromatous changes; this was found in one of the two cases with increased blood pressure.

In Cases 1 and 7 organized *subdural haematomata* were found. In Case 1 there was, in addition, a recent haematoma of the same type which had caused a hemiplegia a few days before death. In both cases epileptic fits had occurred and the haematomata may have been of traumatic origin. It cannot be excluded, however, that the haematomata had given rise to the fits. In both cases the blood pressure had been normal. The hemiplegia which appeared in Case 2 a few days before death could not be related to a recent and localized change.

The histological examination of the *pituitary* did not reveal any consistent deviations from the normal. In Case 2 there was a squamous-celled area in the pars tuberalis; in Cases 2 and 6 there was an excess of basophile cells. There were, in addition, signs of haemorrhages into the gland in Case 6, possibly due to hypertension.

Anatomical findings in other organs.—Extracerebral vascular changes of moderate degree were found in the organs of four cases (1, 4, 5 and 6); in none of the cases could arteriosclerosis be made responsible for the cerebral symptoms. The congenital cystic disease found in Case 9 is noteworthy. In Case 3 there was a pulmonary tuberculosis and acute haemorrhagic pancreatitis. On the whole, the pathological findings, apart from those in the brain, were inconsistent and unspecific; they were unrelated to the changes in the brain, nor did they suggest that the extracerebral disease had acted as a precipitating agent on the cerebral disease.

Cause of death.—In none of the cases was the cerebral disease the direct cause of death. In Case 1 the recent subdural haemorrhage resulted in a state of unconsciousness, during which a fatal bronchopneumonia developed. The remaining cases died from what must be regarded as intercurrent illnesses, most of them of bronchopneumonia occurring in emaciated patients.

Comment.

Early loss of memory, partial or general overactivity, emotional instability and gross speech disorder were the features common to all cases. The impairment of memory showed the characteristics of the organic amnesic syndrome and was unspecific. The increase in motor activity was a consistent feature, though it was not always very pronounced. It was not characteristic of any particular stage of the illness, nor was it confined to night time. In this case material restlessness at night was observed only occasionally. The majority of the patients slept well. This is of some importance for the differential diagnosis between Alzheimer's disease and cerebral arteriosclerosis, where restlessness at night is common. A description of Alzheimer's disease which does not take into account the general motor unrest cannot be regarded as entirely satisfactory; for this reason Grunthal's (1936) subdivision of Alzheimer's disease in three phases calls for modification. In the description of other authors motor unrest has received due attention, and Wilson (1940) pointed to its importance for the differential diagnosis between Alzheimer's disease and Pick's disease. Rothschild and Kasanin (1936) regard it as the result of a compensatory reaction to the disease, and state that it is more profound than in senile dementia. They postulate that in Alzheimer's disease there is an attempt at rejuvenescence in the face of an abnormal ageing process. It is well to realize that the reduction of certain peculiarities of behaviour to compensatory mechanisms does not solve the whole problem. It remains to be explained why those particular mechanisms are being employed and not others.

In a number of cases the behaviour of the patients was reminiscent of that seen in psychoses of toxic origin. This applies particularly to the cases with occupational delirium. The behaviour of other patients had at times much in common with that of involutional melancholics, who often exhibit partial or general restlessness of a spontaneous or reactive nature, accompanied by emotional reactions of distress. The apprehension and tension, so conspicuous in many cases of Alzheimer's disease, again recall the emotional state of involutional melancholia. In two cases of this material, depression and anxiety appeared first before loss of memory was obvious.

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In the case described by Hemphill and Stengel (1940) depression was for some time the only symptom. In two cases reported by Schottky (1932) the diagnosis of an involutional melancholia was made in the early stages and one of his cases committed suicide. The occurrence of such symptoms may have been related to constitutional features. It has been pointed out by Mayer-Gross (1938) that a colouring of the clinical picture by prepsychotic personality trends is not uncommon. There are certain resemblances between the speech of the patients with Alzheimer's disease and deteriorating cases of involutional melancholia who show the same tendency to repetition of stereotyped phrases. It is needless to emphasize that in drawing these analogies it is not overlooked that what may be similar mechanisms are taking place in different functional levels. To point out the resemblance in behaviour seems to be profitable, nevertheless. Further research may reveal that there exists a more than superficial relationship between Alzheimer's disease and the deteriorating type of involutional melancholia. McMenemy, Worster-Drought, Flind and Williams (1939) have described a family in which four siblings suffered from Alzheimer's disease and one from involutional melancholia.

Certain peculiarities in the behaviour deserve interest, e.g. the tendency of some patients to sit in front of the mirror and to talk to their own images. Henderson and MacLachlan (1930) have noted this feature in one of their cases. The same kind of behaviour is sometimes seen in psychoses and severe neuroses, especially in cases with depersonalization; it seems to be the expression of an attempt at fighting the sense of self-estrangement. A similar mechanism may underlie this behaviour in Alzheimer's disease. Another peculiar feature is the tendency to overeating seen in two of the patients. Henderson and Gillespie (1940) described similar behaviour in a case of Alzheimer's disease. Kahn and his co-workers (1931) have observed morbid hunger and gastro-intestinal hypermotility in a case of frontal calcification simulating Pick's disease. It is not possible to decide whether that symptom is an expression of the " iterative occupational unrest," or whether it is a polyphagia due to lesions of the vegetative system. Levin (1936) has described a periodic syndrome in which morbid hunger was associated with motor unrest, irritability, forgetfulness, incoherent speech and somnolence. Following Fulton (1939) he assumes that it is due to an excessive exhaustibility of the higher centres in the frontal lobes. In our cases no consistent abnormalities of sleep were noted. Further investigations, including investigations into the metabolism, are desirable. It is noteworthy that the case of Pick's disease, to be described later, showed a similar behaviour, though that patient seemed to derive satisfaction from chewing only.

The speech disorder in the advanced cases of Alzheimer's disease is very complex and defies classification. Its atypical character has been noted by various observers. Rothschild (1934) has pointed out that it is the result of the general regression to a primitive functional level. It seems, however, that the speech disorder cannot be regarded as an expression of the general reduction of the behaviour only, but can be described as the result of an interaction of an aphasia of the auditory type with a profound general impairment of mental functions. This assumption is in accordance with the view of Goldstein and Katz (1937), that in Alzheimer's disease not only the higher functions of language but also the speech material is involved. Expression as well as reception are gravely affected; there is logorrhoea; features of a verbal (motor) aphasia do not occur. The first sign of speech disorder seems to be a difficulty in word finding, which soon develops into an incapability of correct expression and comprehension. The components to be ascribed to the general disorder of behaviour are perseveration, palilalia and echolalia. They can be found in cases without gross brain lesions and, in a mild degree, even in the normal states of fatigue and slight clouding of consciousness. Some of them are common after epileptic fits, in the twilight states during awakening from coma, and they are sometimes observed in low-grade mental defectives and in catatonics. On many occasions the attitude of the patients towards the act of speaking was partly responsible for their failures. They responded better in what could be called " concrete " situations in Goldstein's sense, i.e. situations of biological relevance on the plane of their functional level. It seems that " concrete " means in those cases more closely related to the ego. Some patients with very advanced speech disorder succeeded in naming parts of their own bodies correctly and often called objects their own when naming them. Both these features can be found in epi-

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leptics in states of clouding of consciousness. It is known that egocentricity is one of the outstanding features of the epileptic personality change. Another tendency, that of naming objects " beautiful," etc., as if to increase their emotional value, is again found in epileptics. All those features can be regarded as due to a regression to a primitive functional level in which the emotional language (H. Jackson) is still preserved. They can be found in the early stages of the language of the child. Gesell and his co-workers (1941) note the " egocentric " nature of the child's language in the earliest stages of speech development when children are able to identify parts of their own bodies before other objects. The possessives " my " and " mine " are the first to appear.

There are further peculiarities in which the speech disorder in Alzheimer's disease differs from a typical aphasia. Sensory aphasics tend to produce paraphasias which show some relationship to the sphere of the object. In this case material the patients very often reacted in a different manner. While hardly ever producing neologisms they used to associate freely, and the words chosen by them could often be traced to external stimuli, clang associations, etc. The patients were " tied to the stimulus " (Goldstein) ; the words they produced were related to the sphere of the objects only as far as the thought disorder, reminiscent of flight of ideas, did not distract from that sphere. Psychotics in delirium and patients in fever react in a similar way, especially if they cannot, or do not want to, focus their attention on conversation. The complete lack of understanding of spoken language in the advanced stage may be due to the symmetrical affection of both hemispheres, especially the temporal regions. Certain features were reminiscent of the speech disorder in Parkinsonism, i.e. the monotony and the tendency towards iteration, which sometimes interfered with the correct production of automatized sequences, as shown in Case 10 (*vide infra*). Those features have been interpreted as resulting from lesions of the basal ganglia (Hertz and Funfgeld, 1928).

It has recently been asserted by various authors that not only a group of cases of Alzheimer's disease but also certain cases of Pick's disease and other atypical presenile conditions are due to toxic processes (Hassin and Levitin, 1941 ; McMenemy and Pollack, 1941). It cannot be denied that some features in the symptomatology, e.g., the delirant behaviour, and some anatomical details invite such a theory, but clinical or pathological evidence is still lacking. As a working hypothesis that assumption can be adopted only if the conception of what implies a toxic process is stretched very widely.

The clinical diagnosis of Alzheimer's disease offers no difficulty if a careful history is obtainable and clinical observation possible. The differential diagnosis between Alzheimer's disease and Pick's disease will be discussed later. Sometimes the differential diagnosis between Alzheimer's disease developing late and senile dementia may be difficult or even impossible. The much more massive character of the symptoms in Alzheimer's disease should make the diagnosis possible in most of those cases.

Encephalography has proved valuable ; it is not indispensable in typical cases, and, as Critchley has pointed out, should be used with care for differential diagnosis. Electro-encephalography may become an additional diagnostic aid, especially where a differential diagnosis between Alzheimer's disease and localized cerebral lesions has to be made. The following case proves that a clinical diagnosis can be established beyond doubt on the basis of the clinical picture with the aid of encephalography ; electro-encephalography was employed also. The case is reported for the additional reason that it shows a symptom which hitherto has not received much attention.

Case 10.—Mrs. E. V—, aged 52, admitted on 24.vi.1942. *Family history :* Negative. The patient, who had been a shy and reserved woman previously, became over-affectionate and uncontrolled in her emotional behaviour. Loss of memory appeared, the patient became talkative and garrulous and wandered about restlessly. In recent years a speech disorder similar to that seen in Alzheimer's disease developed.

Condition on admission.—In her general behaviour the patient is restless and mildly agitated and shows signs of distress. When spoken to she talks almost incessantly and does not pause when the partner in conversation is speaking ; she speaks in a monotonous manner and the articulation is not quite distinct ; she shows echolalia, palilalia and logoclonia. The understanding of spoken language is greatly impaired. Specimen of conversation : (How are you ?)

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" Dear, dear, dear " (inarticulate mumbling follows). (What is your name ?) " The time, the time, one wants, wants, wants." (How old are you ?) " If you could a, could-a-could-a, dear, dear, dear, let me see, let me see me see." Watch is shown to her. (What do you call this ?) " 5, 5, 5, funna funna funna and after after de after. It's the time, time, time . . ." (Pencil) " Yes—I can't, can't, can't, to can you see it, do for never to do do do going going gone. . . ." (Cigarette) " Stimparpareparepa." (1, 2, 3, 4 . . .) " 5, 6, 7, 8, 9, 10, 10, 10, eleven, leven, leven, last night, night, night." (a, b, c, d . . .) " B, b, b, b, fe, 5e, 5, 6, 7, 8, 9, 9, 9." (Let me see your tongue) " Tongue, tied, tied, just 30, 30, 30." (She is asked to name parts of her own body, the examiner touching them.) (Nose) " Hear, hear, rear, rear." (Ear) " This is my ear, ear, ear." (Hand) " You cannot see to go over the hand, the hand, the hand." In handling objects signs of apraxia occur only in more complicated tasks while simple tasks and more primitive actions are carried out correctly. *Reaction to pain :* When pricked with a needle the patient does not withdraw the afflicted extremity or she does it only very slowly and inadequately. More often her reaction is paradoxical, i.e. she would follow the needle as if she wanted to be pricked more. She shows the same reaction to pain over the whole body and she does not withdraw her tongue when pricked. The same behaviour is shown when other stimuli to which the appropriate reaction is that of withdrawal are inflicted upon her, e.g. strong flashes of light, loud sudden noises, etc. *Physical examination :* Emaciated woman. Cardio-vascular and other systems healthy. B.P. 140/80. The neurological examination reveals an exaggeration of the knee and ankle jerks, otherwise no abnormal signs apart from the abnormal reaction to pain. No signs of Parkinsonism. *Encephalography* shows a generalized cortical atrophy of extreme degree, particularly prominent in the region of the frontal poles ; the lateral ventricles are both very greatly enlarged and the basal cisterns are very spacious. *Electro-encephalography* (Dr. Beevers) : All regions of the head show small (20 mu V.) irregular potential changes with no sign of any rhythmic activity whatever. This finding is suggestive of a widespread degenerative process not associated with hypersynchronous activity of cortical neurones.

Comment.—The symptomatology of this case is essentially the same as that of the cases described above. The encephalography confirmed the diagnosis. Further investigations will be necessary to show whether the electro-encephalogram may be of use in the differential diagnosis not only between Alzheimer's disease and localized cerebral lesions, but also between Alzheimer's disease and Pick's disease. Experiences on that subject are still scanty and inconclusive (Gibbs and Gibbs, 1941). It will be interesting to learn whether cases of Alzheimer's disease with epileptic fits show an electro-encephalogram different from that in cases without.

This patient showed a peculiar reaction to pain and other stimuli to which the appropriate response is that of withdrawal ; not only was there no such reaction, but the patient sometimes responded in a paradoxical manner. Her behaviour conformed to that described by Schilder and Stengel (1931) as " asymbolia for pain " in cases with localized lesion of the left parietal lobe. This symptom is not as a rule found in Alzheimer's disease ; other patients reacted to pain normally and even in an exaggerated way, as was to be expected in patients who tend to exhibit increased reactions to outward stimuli. It remains to be seen whether the presence of that particular symptom is related to a more localized atrophy of the parietal cortex.

A Case of Pick's Disease with Involvement of the Temporal Lobe.

CASE 11.—Mr. R. M. S—, fireman, aged 62, admitted on 5.x.1936. *Family history :* Father died aged 62, having had a hemiplegia preceded by loss of memory. Mother died, aged 82, from cerebral haemorrhage. An elder brother died from Bright's disease. Another brother had a delirious state previous to his death from heart failure at the age of 58. Two younger sisters are healthy, but their blood pressure is said to be unduly high. *Personal history :* The patient became abnormal when he was 54. There was marked loss of memory, especially for recent events. He became lazy and indolent—features which were quite at variance to his former active and industrious disposition. He had to retire as unfit, and had to be looked after by his sister. He had lost interest in things, was unco-operative, childish and facile. If not allowed his own way he would lose his temper and even become violent. Sometimes he was found standing at a street corner, handing out sweets or money to children. He was very quiet, never initiating any conversation himself but able to answer questions ; his speech became increasingly limited, until he became unable to converse three years previous to admission. Eighteen months later he had become quite unable to understand spoken language. Emotionally he was very unstable. If music was played he would invariably weep like a child. Otherwise he would respond with laughing. For the last year before admission his habits have become faulty. His physical health has been good.

Behaviour in hospital.—Patient lies contentedly in bed, smiling and apparently in good spirits, repeating in a stereotyped manner, " Cheerio Jimmy, I love you." He is unable to feed

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himself. When allowed up he wanders around the ward. He fails to respond to most questions, or else utters stereotyped phrases. He often shows echolalia. The following is a specimen of his conversation. (Good morning.) "Cheerio Jimmy, cheerio Jimmy. Going to go out Jimmy, going to go out, Jimmy, Cheerio Jimmy." (Sit down.) He has to be placed in a chair. "Go away to house, to house, Cheerio Jimmy." (Will you show me your tongue?) "No, no Jimmy, no, no 18, just about 19, just about 191, in my young days, in my young days." (What is your name?) "In my young days, in my young days, I forget things now, burn the big fellows, in my young days, burn the young fellows. Cheerio Jimmy," etc. (That's all, thank you.) "That's all right Jimmy. Get to hell, Jimmy," etc. He goes on repeating the same phrases, accompanying them with a facile laughter as if he had made a great joke. Occasionally he reveals some insight into his deficiencies. Once he said: "I have been a long road forgetting things. Different when you are young." He is unable to read but occasionally recognizes single letters. When given a pencil and asked to write he wrote: "Lids, the them the letters." He seems to be able to use simple objects but fails in more complicated tasks. *Physical examination* does not reveal any signs of a localized lesion of the C.N.S. Reflexes normal. No signs of Parkinsonism. Other systems healthy. B.P. 142/80. Blood Wassermann negative. 3.10.36: Unchanged. 22.ii.37: He is up every day, walking about a good deal, quietly smiling to himself and repeating his stereotyped phrases when addressed; easy to control and never impulsive; sleeps well. Dirty in his habits, but not incontinent. 28.ix.37: Frequently stuffs pieces of paper and cardboard into his mouth and resents attempts to take these away from him. His physical health is good. 24.v.38: His speech is limited to "Cheerio Jimmy." He is always stuffing things into his mouth. 29.iii.38: He has gradually lost every power of speech and he does no longer utter his stereotyped phrases. He shows hardly any initiative and is confined to bed. He is going downhill physically, showing slowly progressing emaciation. 15.iii.40: Permanently in bed. Completely mute. Progressive emaciation. 19.xii.40: Died under signs of bronchopneumonia.

Post-mortem examination (Dr. W. Blackwood).—*Brain:* The brain is small generally. There is a certain amount of atrophy of the frontal regions, but there is extreme symmetrical atrophy of both temporal lobes affecting chiefly the anterior halves of the convolutions. There is no demarcation line between the atrophied and the comparatively normal parts. Over the atrophied parts the leptomeninges are thickened, opaque, ragged and yellowish in colour. The basal vessels show diffuse pale thickening. Dilatation of the third and lateral ventricles. There is extreme atrophy of the white matter of the atrophied temporal regions; in the anterior parts of the temporal gyri all that remained of the white matter is a central, faintly yellow filament. The basal ganglia are symmetrically small. *Microscopically:* In the affected temporal areas the following changes were noted:—Blood vessels: Pickworth preparations of the superior temporal gyrus show a tortuous course (artefact due to shrinkage). In paraffin sections there is a moderate degree of fibrous thickening of the vessels which has not, however, narrowed their lumen; only one arteriole was found with hyaline degeneration. There is a severe reduction of nerve cells with replacement gliosis in the atrophied areas of the cortex; the ganglion cells show shrinkage, loss of Nissl substance, margination of the nucleus. No neurofibrillary tangles nor argyrophile plaques can be demonstrated. Some of the nerve cells show cytoplasmic granules as described in Pick's disease. In the basal ganglia there is a slight diffuse gliosis in the putamen with an occasional perivascular accentuation. The corpus callosum is somewhat thin and shows some perivascular aggregation of compound granular cells. Pons and cervical cord normal. Pituitary healthy. In the cortex microglia could be demonstrated, but the number of cells was not excessive. Astrocytes were markedly increased in both white and grey matter. In the not markedly atrophied cortical areas the cell loss was trifling. There was an increase of lipochrome. There was a diffuse gliosis present, moderate in motor and occipital cortex, well marked in the frontal region. *Other organs:* Bronchopneumonia left side. Heart small; patchy atheroma of coronary vessels; atheroma of abdominal aorta. Intestines healthy, apart from a small healed ulcer in the stomach. Liver reduced in size; cut surface, brown, firm in consistence but not cirrhotic; four mulberry stones in the gall bladder. Remaining organs healthy. *Microscopically:* Bronchitis and bronchopneumonia. Chronic venous congestive changes in liver and spleen. Mild arteriosclerotic changes of the kidneys. Moderately large adenoma in the cortex of one suprarenal.

Summary.—The family history is inconclusive for an identical hereditary factor, though it is noteworthy that both parents died from brain lesions and a brother developed psychotic symptoms of the organic reaction type. The outstanding feature of the symptomatology in this case was the growing lack of initiative, which was conspicuous from the beginning. He seemed to have reverted to an infantile level of behaviour comparatively earlier than the cases of Alzheimer's disease. Primitive emotional reactions to external stimuli were noted in the early stages and the patient had a certain amount of insight into his deficiencies. There was, however, no appropriate emotional attitude to the illness and the patient used to exhibit a facile cheerfulness, sometimes showing reactions similar to those described as Witzelsucht. In the last two years of his illness he showed no spontaneous

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mental activity and was completely mute. The anatomical examination revealed a circumscribed temporal atrophy of an extreme degree and a slight frontal atrophy. There were no plaques nor Alzheimer's fibrillary changes. The white matter of the atrophied lobes was extremely reduced and the corpus callosum was reduced in volume.

Comment.—It is remarkable that in this case of circumscribed temporal atrophy, in which an aphasia of the sensory type was expected to remain a prominent feature, speech ceased completely in the advanced stage of the illness. This was associated with the general lack of initiative, which became extreme as the illness advanced. The anatomical findings in the frontal lobe were not sufficiently gross to account for that development, though the temporal atrophy involving both the cortex and the white matter cannot have remained without influence on the function of the frontal areas. On the other hand, it is well to remember that bilateral temporal lesions, especially in children, sometimes result in both word-deafness and word-muteness, and it is possible that the diffuse degenerative changes present in addition to the circumscribed atrophy contributed towards creating conditions similar to those existing in a child with localized lesions. Furthermore, loss of expressive speech in adults with lesions of the temporal lobes has been observed if, at the same time, there was massive destruction of the subcortico-commissural systems. Similar conditions were found to exist in this case. It is noteworthy that the patient for some time exhibited emotional reactions reminiscent of Witzelsucht, but this is, according to recent views, of no significance for localization (Wilson, 1940). The most characteristic and consistent change in the general behaviour was no doubt the lack of initiative. This patient was the only one in this series whose relatives reported laziness and indolence as the most conspicuous change from the beginning of the illness. As the patient came under observation only when the illness was well advanced none of the investigations could be carried out which Goldstein and his co-workers (1937) have undertaken in early stages of Pick's disease.

Some Considerations on the Differential Diagnosis between Alzheimer's Disease and Pick's Disease.

The clinical differential diagnosis between these two diseases often meets with great difficulties. Pick's disease is regarded as a heredo-degenerative affection, while in Alzheimer's disease the hereditary factor is said to be negligible. In Pick's disease the memory disorder is said to occur later in the course of the illness than in Alzheimer's disease (Grunthal, 1936; Henderson, 1941; Bouton, 1940; Nicols and Weigner, 1938). Kahn and Thompson (1934) have pointed out that there is no symptom or finding characteristic of either disease; only the consideration of the total picture and the whole development may in typical cases make the differential diagnosis possible. The occurrence of epileptic fits is generally regarded as suggestive of Alzheimer's disease. The most important point of all is no doubt the difference in the general behaviour; partial or general over-activity in Alzheimer's disease, lack of initiative resulting in complete loss of activity in Pick's disease. It must be kept in mind, however, that the over-activity in Alzheimer's disease is often only a partial one, and that the lack of initiative may not become obvious in the early stages of Pick's disease. The emotional reactions of distress and mild agitation are not as consistent in Pick's disease as in Alzheimer's disease; there is little likelihood of a case of Pick's disease exhibiting features reminiscent of involutional melancholia. On the whole, it can be stated that a differential diagnosis is possible on the basis of an investigation into the total behaviour presenting itself in cross sections as well as in the longitudinal section.

The fundamental difference of the motor and emotional behaviour in Alzheimer's disease and Pick's disease invites a consideration based on differences in the anatomical findings and on the results of certain recent therapeutic experiments. Even the naked-eye examination shows that the extreme degree of localized atrophy in Pick's disease cannot be due only or mainly to the reduction of the cortex, but is brought about by an additional extreme atrophy of the white matter. It obviously is the combination of both that is responsible for the shrinking of whole lobes in Pick's disease. The degree of cortical atrophy alone seen in Pick's disease is usually not very much in excess of that found in the more markedly atrophic areas

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in Alzheimer's disease. It is true that the white matter is not unaffected in Alzheimer's disease, but it is never reduced to mere filaments as often seen in Pick's disease. The massive destruction of white substance in Pick's disease is bound to involve not only great parts of the intrahemispheral fibre systems, but also of those which form the corpus callosum. Freeman (1941) assumes that in Pick's disease the white matter is involved first. Hassin and Levitin (1941) have recently stressed the severe affection of white substance in Pick's disease; they were justified in pointing out that these changes have not received the attention they deserve. It can be stated that what constitute the characteristic *anatomical* features of Pick's disease as distinct from those of Alzheimer's disease are the circumscribed nature of the process, the absence of plaques and Alzheimer's fibrillary changes and the extreme involvement of both grey and white matter, whereby the degree of destruction of the white matter sometimes may even exceed that of the cortex. Considering that plaques and even Alzheimer's fibrillary changes have been found in some cases of Pick's disease, the extreme involvement of the white matter may be found to constitute the most outstanding difference. There are two groups of clinical experiences which invite an attempt at correlating those anatomical differences with the fundamental differences in the behaviour in Alzheimer's disease and Pick's disease. Firstly, the fact that lack of spontaneity and " drive " is an important feature in the symptomatology of cerebral lesions resulting in extensive destruction of the white substance including the callosal fibre systems. Secondly, it has been shown that frontal leucotomy carried out in cases where motor unrest and distress were prominent features resulted in the mitigation or subsiding of those symptoms which gave way to contentment and a certain loss of initiative (Freeman, 1941; Fleming, 1942). The changes brought about by frontal leucotomy are, of course, of a subtle nature as the lesions are not on a massive scale; they proved beneficial by reducing the abnormal motor and emotional unrest. There is no doubt, however, that features reminiscent of those seen in Alzheimer's disease give way to a behaviour reminiscent of that in Pick's disease. In fact, Freeman remarked that the anatomical results of frontal leucotomy would appear to resemble superficially what we find in Pick's disease, and suggests that the results of psychological tests in Pick's disease and cases which had been subjected to frontal leucotomy should be compared. He is inclined to regard the " reduction of the affective component " as the result of the severing of the connection between the frontal cortex and the thalamus. According to Freeman (1941) the patient, after the operation, is lacking in self-consciousness, and this author suggests that removal of the consciousness of self is the important factor in the treatment of involutional melancholics. " The patient achieves peace of mind." Freeman did not extend his comparison of the anatomical changes in Pick's disease with those brought about by leucotomy to the clinical field. It seems that excessive " peace of mind " is characteristic for Pick's disease, while agitation and often distress colour the behaviour in Alzheimer's disease. One may conjecture that a leucotomy carried out in a typical case of Alzheimer's disease may change the clinical picture into one very similar to, or even identical with, that of a typical case of Pick's disease. It is clear that such a correlation holds good only for typical cases, and will be obscured in cases where the anatomical features are less characteristic. The question may be ventured tentatively whether another distinctive feature of Pick's disease, i.e. the absence of epileptic fits which are a frequent accompaniment of Alzheimer's disease, is not due to the extensive destruction of white matter which prevents a spreading of epileptogenic stimuli in the degenerating cortex.

Conclusions.

The symptomatology of Alzheimer's disease has been studied in ten cases, nine of them anatomically verified. In addition, one case of Pick's disease with involvement of the temporal lobes has been reported. Various features of the symptomatology of Alzheimer's disease which have received little or no attention hitherto have been described. The general behaviour and the speech disorder have been analysed. The relationship between certain clinical features of Alzheimer's disease and of involutional melancholia has been demonstrated. On the basis of well-known clinical observations in brain lesions and of recent therapeutic experiences in cases with involutional depressions treated with frontal leucotomy an attempt at

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correlating the differences of the behaviour in Alzheimer's and Pick's disease with differences of the anatomical changes has been made.

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AFFECT IN SCHIZOPHRENIC REACTION TYPES.*

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THE purpose of this paper is to illustrate and discuss by case-records the affective responses of a number of patients with a schizophrenic reaction type of mental illness. Recently the energies, time and attention of neuropsychiatrists have been focused on the newer methods of treatment of the schizophrenics. As a result of such intensive and extensive study, interest in other problems of schizophrenia has been rekindled. The " shock therapies " have seemed to crystallize certain factors for us. They have tended to bring out into clear relief certain old factors and have produced many new facts so that we have been forced to re-orient ourselves in many diverse ways. Prognosis has been altered, and this fact has led to a minute scrutiny of the patients who have been treated to determine what factors are operating for or against a favourable outcome. One of these is the *affective* factor. Patients that have retained a good affective response may still be able to combat reality and its ever-present problems of adjustment and re-adjustment. They may recover spontaneously, or they may do so quicker with the help of the " shock therapies."

Textbooks of psychiatry have for decades handed down the dogma that the affect in schizophrenia or dementia praecox is blunted, dull, deteriorated, and that the predominant affect is apathy and indifference. They have stressed the gradual deterioration of the affective side of the personality structure. We would like to emphasize as a result of our studies, that many patients with a schizophrenic reaction type of illness have adequate affective responses with adequate accompanying physical alterations that are observable. We also would like to point out that some schizophrenic patients still have a large reservoir of affective energy that is available, but because of some central morbid process as yet unexplainable, they are not able to express themselves in the language of the affects that is understandable by clinicians. They may very well represent a disturbance that might be labelled " Expressive Aphasia of the Affects." Some schizophrenic patients exhibit all the peripheral signs of stimulation of the autonomic nervous system, but do not experience the subjective sensations that so-called normals usually experience. It is with these thoughts in mind that we have approached our problem. We are reminded at this juncture of the words of Kraepelin in regard to the state of the emotions in dementia praecox : " Very striking and profound damage occurs as a rule in the emotional life of our patients. The most important of these changes is their emotional dullness—the singular indifference of the patients towards their former emotional relations, the extinction of affection for relatives and friends, of satisfaction in their work and vocation, in recreation and pleasures, is not seldom the first and most striking symptom of the onset of the disease. The patients have no real joy in life, ' no human feelings.' To them ' nothing matters ; everything is the same.' 'They feel no grief and no joy,' ; ' their heart is not in what they say.' One of the most characteristic features of the disease is a frequent causeless, sudden outburst of laughter, that often is strikingly in evidence already at the very commencement. Moral sentiments also and their regulating influence on action

* Case material obtained at the Jordanburn Nerve Hospital and the Royal Edinburgh Hospital for Mental Disorders, Edinburgh, Scotland, under the guidance of Prof. David K. Henderson, Medical Director.

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suffer severe loss. Loss of sympathy is shown in indifference and want of understanding for the misfortunes of others. Another phenomenon of emotional dementia is the disappearance of delicacy of feeling. The patients no longer have any regard for their surroundings; sudden oscillations of emotional equilibrium of extraordinary violence may be developed." Kraepelin continues and remarks about "the weakening of those emotional activities which permanently form the mainsprings of volition," and mentions that the "result of this part of the morbid process is emotional dullness." He also speaks of "intrapsychic ataxia" as elaborated by Stransky as disharmony between the activities of the intellect and emotion. There was no thought of the personal conflicts or the reactive disturbances between the individual and the environment. He based much of his conclusions on well-advanced cases with more or less deterioration, believing that only the more advanced cases would give a complete and accurate picture of the entity that he was interested in. Probably the early cases were not studied so assiduously nor were those which had sudden onsets with a rapid clearing of the symptoms. It does not seem probable that the cases to be presented here differed materially from the cases that were available for study in Kraepelin's day. We must conclude then that Kraepelin was interested in the late, well-developed case, and that he did not pay too much attention to the state of the affects in the early cases. The affects must have been as well preserved in many of his cases, but because of the absence of the analytical or the psychobiological approaches, the real affective state was not truly evaluated. We feel that the views of Kraepelin on the state of the affects should be modified in the light of the recent observations within the past few years. Those patients who have received any one or more of the various "shock therapies" have usually shown much of their post-treatment alterations in the affective sphere. Affect can be felt in many of our patients if their problems are touched upon, and in many affect is still diffused over their whole personality. We must still study our patients and their reactions minutely and recount them in descriptive terms, but we can now bring to our approach the more detailed and all-embracing techniques of the recent decades. If we can look upon our patients as problems in human development and regardless of our theories as to the development of the personality, we will still be able to determine how adequate the affective response has been in the past and what its status is at present.

We prefer to use the term affect because we feel that it is a broader term, including both the emotions and the sentiments, and here we lean to the views of Ruckmick. Emotion has been associated by many investigators with aspects of the instinctive patterns of reaction. Affect is a more generic term and implies "feeling tone" or "feelings." It includes both the specific, easily distinguished emotions like anger, fear, love, and those which are less easily distinguished, and are assigned to the class of feelings such as superiority or inferiority. This latter statement was promulgated by Dr. Morton Prince while he was discussing a paper on prognosis in schizophrenia presented by Drs. Strecker and Willey at a meeting of the Association for Research in Nervous and Mental Diseases in 1925. Many men use the terms affect and emotion synonymously. There has been much discussion as to their similarities, differences, and their real meanings. Dana, in the same discussion above noted, felt that feeling was associated with a sensation and emotion with an idea. In this respect he considered that if the term affect was used to include both concepts, it was a bad word because it was a "kind of a mixture of two psychological units." White felt that "'affect' was a generic term that covers the whole field and 'emotion' a more specific term." Campbell, in discussing the same paper, felt likewise and concluded: "And when we are dealing with changes of mood, such as we are familiar with in certain disorders, with variations between depression and elation, or modifications of these aspects, I think it is very useful to have a special term; although there is no such thing as intellect *per se*, nor affect *per se*, nor will *per se*, in our daily behaviour, in our continual activity, we can describe with mutual understanding, I think, that aspect of our mental life to which we refer as 'affect' and which is different from the very specific type of reaction, the very specific pattern to which we give the term 'emotion'." McDougall has stated that all mental life has three aspects, viz.: cognitive, conative and affective, the latter being a state of the feelings. It is these states of feeling that we have attempted to study in our patients. In doing so we did not attempt to distinguish between a pure or an impure affect. The former is supposedly

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closer " related to primitive general states of well being or the opposite than many of the latter." Meyer (quoted in Muncie's *Psychobiology and Psychiatry*) differentiates affects into " diffuse nontransitive affective states, as in diffuse sadness or elation, while the transitive affects refer to ' affects with an object, as anger '."

These states of feelings express themselves physically and are grouped under the term " affective response." The latter includes the alteration of the chemistry and mechanics of every organ and system in the body. As Muncie has stated in his recent book, " The affective life refers to a variety of diffuse reactions of the organism mediated through the sympathetic-hormonal-unstriped-muscle systems and accompanied by a certain state of pleasure or its opposite or their equivalents, and with less or more object reference." Muncie has outlined admirably the attempts to assess the affective life of the individual by the following means :

(*a*) Introspective reporting of emotional experience.
(*b*) Judging emotion from general motility, and attitude, especially the face.
(*c*) Determination of the physiological participations, especially cardio-vascular, respiratory, metabolic, and electrodermal.

Muncie feels that " they all give inconclusive results, for their reduction to standardized measurement is practically impossible." He mentioned several reasons for this, including the fact that various emotions are expressed by the same physiological systems, thus making differentiation impossible, that " degrees of the same emotion are not accurately reducible to quantitative measurements by the known physiological participants, that different individuals with objectively similar emotional display show surprising differences in the physiological participation," that " the interpretation by various observers of the kind of emotion from the facial expressions is a hazardous procedure," that " the emotional state is rarely pure and unmixed," that " the constitutional element plays a very large role making for great individuality of reaction."

We subscribe wholeheartedly to the above views and realize that there are many shortcomings in the various methods. However, in the absence of an ideal approach to the study of the affective life and in view of our desire to use the simplest methods for bedside use which could be used by all clinicians, we adopted and relied upon the following four methods :

(*a*) Introspective reporting.
(*b*) Judging of emotions that might be present from the " general motility and attitude, especially the face."
(*c*) Word-association tests.
(*d*) Psychiatric interviews.

Many methods employed in affective study have used complicated apparatuses, and other methods need the co-operation of a biochemical laboratory. The affective state can be altered by the apparatuses *per se*, and when one deals with individuals who may have paranoid trends, etc., the results are not without corruption. We wished also to keep the study on a personal and human level, realizing, however, all too well the fallacies and biases that are liable to develop. Muncie (1940) mentioned that " trained observers give much the more informative accounts," and we feel that experience aids one immeasurably. Kanner (from Muncie) concluded that the judging of emotions from facial expressions was rather hazardous and paradoxical at times. He found that the ability to interpret the existing emotional state from the facial expressions varied widely from observer to observer. A somewhat diametrically opposed view of this matter comes from Sullivan (1925), who has stated : " The countenance is an important field for the expression of the affective state existing within the individual. The postural tension of the facial muscles works in a general molar (mass) fashion, and in a specific and detailed sense seems to be intimately a correlate of the feelings—the notion of non-consciousness of an affective feature is still more tenable when we have regard to the all-or-nothing character of apperceived affective experience ; one may generalize cautiously to the effect that the more intense and determinate the affective awareness, the more completely will the facial postures express that affective state." Sullivan felt that conscious affective situations *tend* to be reflected by the facial postures. He also believed that simulation of affective states was very possible in the early schizophrenic states, and thought that by studying the circumoral tensions in both repressed and simulated affective situations differences can be ascertained.

The data which we obtained from introspective reporting varied from patient

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to patient and depended greatly on the condition and the intellectual equipment of the patient. We found a close correlation between the results of introspective reporting and the word-association tests. In a few patients in which there was a marked personality disintegration it was noticed that they could report their feelings quite adequately, but in the test situation their replies became unintelligible, irrelevant, and neologistic.

The word-association test seemed to us to be a most valuable method to ferret out affective situations that had not as yet been unearthed by our other methods. This test was given to all of the patients at least once and most of them twice. It is true that ordinary conversations will bring out many associations and references to affective states and to previous emotional trauma, but it is likewise true that presenting a stimulus word to a patient brings about many times a reflex emotional response in a trigger-like fashion. This emotional response usually revolves around a very strong personal complex which is usurping the centre of the patient's attention at that particular time. Complex indicators are therefore obtained, and among these we may mention character of reaction time, spreading of the reaction over subsequent reactions and the conduct of the patient. We feel that in recent years this method has not been utilized as extensively as it should be, and that a revision of its use would again prove its effectiveness. The list of words which we chose was that of Kent and Rosanoff. These words had been given to a large number of persons, and the test was more or less standardized as far as reactions were concerned. The list is as follows:

KENT-ROSANOFF LIST OF STIMULUS WORDS FOR ASSOCIATION.

table	wish	stem	bitter
dark	river	lamp	hammer
music	white	dream	thirsty
sickness	beautiful	yellow	city
man	window	bread	square
deep	rough	justice	butter
soft	citizen	boy	doctor
eating	foot	light	loud
mountain	spider	health	thief
house	needle	bible	lion
black	red	memory	joy
mutton	sleep	sheep	bed
comfort	anger	bath	heavy
hand	carpet	cottage	tobacco
short	girl	swift	baby
fruit	high	blue	moon
butterfly	working	hungry	scissors
smooth	sour	priest	quiet
command	earth	ocean	green
chair	trouble	head	salt
sweet	soldier	stove	street
whistle	cabbage	long	king
woman	hard	religion	cheese
cold	eagle	whiskey	blossom
slow	stomach	child	afraid

This list of words was presented to the patients after there had been a number of psychiatric interviews. It happened many times that the entire list could not be given because of fatigue, poor co-operation, or a great display of affect. On occasions words which had a personal significance for the patient were injected into the test situation. The materials needed were a pencil, paper and a watch, preferably an ordinary wrist-watch. We began by using a stopwatch, but abandoned it because we discovered that the use of it distracted the attention of the patient, developed suspicious trends in many which interfered with the test, and on a few occasions forced the cessation of the test. By keeping the wrist turned so that the face of the watch is plainly visible, time reaction to the second can be noted without the patient being aware that he is being timed. Each word was given once and slowly. The reaction time was noted at once and the exact response of the patient

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or the immediate reaction was also recorded. With the verbal response the general bodily alterations that transpired were noted. Where the condition of the patient made it possible, we asked that an elaboration of his affective response be made and a possible explanation be offered. The subsequent remarks were also recorded. Many times the patient was able to report very interesting and revealing introspective data which a particular word had recalled from his memory. We usually gave as many words as was practical at that time and then later we repeated the test, and in this fashion comparisons could be made which proved to be very interesting in those patients who were receiving the various shock therapies. At first we grouped the verbal responses of our patients according to the method used by Jung, but found that this complicated grouping was not of much value to us in our problem. Briefly we discovered that the more intelligent patients usually responded with words that fell in the personal or/and general concept categories. The less intelligent patients responded by the use of words that could be classified as phrase ending, adjective supplying, predicate, contrast, similarity, rhyming and clang words. These general replies seemed to hold true despite the severe disintegration of the personality that occurred in many patients. It was observed that at the time of the test the patient could not or would not discuss the meaning of certain reactions, but at a later date the full significance was forthcoming. The starting-points for many subsequent discussions were also obtained by the use of this simple and quick method. In our hands we feel that the test is quite adequate for an estimation of the affective state, is quite objective, and despite the personal equations that are ever present, is satisfactory.

Many interviews were held with these patients for investigation and therapy. As pluralistic an approach as possible was used. Analytical mechanisms often were relied upon for explanations. In the final analysis the patient's general personality, intellectual equipment, state of the morbid process and co-operation all entered into the determination of what approach to employ. We relied much on the psychobiological approach and many frank discussions were held with those patients who were well enough, their affective reactions being observed and noted coincidentally.

Material.

As to the type of patients that we investigated, we chose first only those patients who were considered by the hospital staff to be representative of the schizophrenic reaction type of mental illness, and secondly only those patients who showed affective responses which by nature of the selection formed a rather select group. We realize that what is meant by schizophrenia in one part of the world is not so considered in the other, and sometimes not even in the same hospital staff. Campbell (1930) aptly said, " With a complicated and difficult problem like schizophrenia (dementia praecox), it may be of some interest in one clinic to know how people think in another clinic, and what they mean by the words they use. If you want to know what we mean by schizophrenia in Boston, we would have to tell you that we are uncertain ourselves about it." We use the term and the syndrome in the way that Henderson and Gillespie have used it and defined it in their *Textbook of Psychiatry* (1940). Many clinicians use the terms schizophrenia and dementia praecox synonymously, and this is approved by the American Psychiatric Association in the *Standard Classified Nomenclature of Disease* (1938). Darrah (1940) recently suggested that we should differentiate the two entities from each other. He felt that dementia praecox was a grave mental disease in which the onset was nearly always insidious and usually developed during adolescence, that there was neuropathic endowment, usually an asthenic or dysplastic habitus, and that this process always progressed to deterioration. On the contrary, he felt that schizophrenia was a mental disease in which the onset was acute, could occur at any age, that the course was milder, that there were no neuropathic traits in the family, that it was non-deteriorating, that it could remit or recover at any stage, that it often seemed to be precipitated by some environmental distress or conflict. At this juncture we shall quote C. Macfie Campbell from his book *Destiny and Disease in Mental Disorders* (1935): " In the present discussion we are concerned with a group of patients which we leave poorly delimited and vaguely characterized, consisting of individuals who are failures from the point of view of the social group, failures of a special type, failures temporary or permanent. We shall discuss them with

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no preconception as to the presence of any disease, but shall consider them as troubled souls or non-conformists who happen to be available for study." Campbell presented his material according to the following groups. His first group included patients who showed emotional turmoil and unsystematized behaviour; his second group showed a withdrawal of interest, apathy, tension with outbursts, hallucinations and occasionally delusions; his third group encompassed those patients with a distorted world picture in which they exhibited wish-fulfilling phantasies, suspicious trends, etc. Our patients could fall naturally into this classification, which seems broader than that of Kraepelin. We have not made the inclusion of our patients into a subgroup an important point. We shall now proceed with the presentation of patient records in an attempt to point out that some schizophrenic patients do have affective retention.

CASE 1.—*Summary:* Male, aged 23, single, admitted because of mental confusion, suspicions of employer, auditory hallucinations and odd behaviour of recent occurrence. Worried over masturbation, developed inferiority feelings, poor concentration, easy fatigability, insomnia, and various delusions about his genitalia. Gradual improvement with insulin; final recovery.

W. R—, male, aged 23, single, dental assistant, was admitted to hospital in March, 1930. He complained of mental confusion and of inability to comprehend many personal problems, particularly relative to the auditory hallucinations. He stated that he could not sleep well, eat or work with efficiency because of worry about his masturbation and its effects and of his suspicions of his employer. The family history revealed two sisters who were described as "odd," a mother who was a very passive and weak-willed person, and a brother who was an alcoholic. The patient was described as very quiet, timid, shy, and home-loving boy. He had never had any friends of either sex and he had not inclined towards sports or dancing. He finished secondary school, became a dental assistant and was considered a good worker. He had always avoided responsibilities, detested criticism, desired to be left alone and tended to suspect people. He was an omnivorous reader. He met failures and disappointments with difficulty, and readjustments were retarded and not very successful.

Up to eighteen months before admission he had adjusted quite well except for episodic difficulties to the social milieu he moved in, but during the last seven years he had been beset with his masturbatory problem and this was constantly before him. He was torn between desire and the belief that it was a mark of degeneration. The immediate precipitating factor of his acute illness seemed to be a statement that his sister had inadvertently made to him during a conversation 18 months before admission. She had casually remarked that she had delivered him because the doctor was late in arriving. This thought remained with him and soon became the central idea around which his mental life revolved. "I was turned outside in by thinking of this." He withdrew more from his friends, his masturbation problem became more intense and he became more agitated and tense. He developed many odd ideas about his genitalia. He was sure that his employer knew about his "sin" and soon ideas of reference developed towards him and this trend spread to others. Delusions of persecution developed naturally next. These thoughts were stronger in alternating periods, and during those times when they were weaker, he would become confused because he would ridicule them and wonder how they had ever developed. The intervals between these "lucid" periods became shorter, and soon a constant confusional state was present. Depression developed coincidentally with his growing tension and worry, and was prominent in the hospital. He heard for many months before he became confused a man's voice calling him "filthy names" and he reacted violently to these voices.

The predominant symptoms which this patient presented were confusion and depression. His conduct at first was determined by his confusion, but gradually his behaviour except for a tendency to withdraw became quite acceptable. He never showed apathy or indifference to his problems and was always acutely interested in them. Incoherence, irrelevancy and irrationality were absent. He discussed his problems intelligently and with much apprehensiveness and feeling. His depression cleared gradually as did his auditory hallucinations. His physical and neurological examinations were negative, as were the laboratory reports.

During many psychiatric interviews he reported his introspective ruminations. He was usually tense during discussions. He stated that his emotions attached to his worry over masturbation were always those of fear, shame, guilt and inferiority. When some of his ideas of reference were in the ascendancy he felt bitter to those around him. He had tried very hard to control his emotions, but at times he was unable to. During his hallucinatory experiences he felt many conflicting emotions surging up in him, but never reaching their goal of expression. He tried to express them outwardly, but felt that he was unable to. His experiences seemed to have been similar to those of "Jonathan Lang." Writing from his personal experiences that covered nine years, this schizophrenic patient related vividly with much psychological insight the intense affective upheaval that gripped him. He refuted the popular idea that a schizophrenic patient had a progressive deterioration in the emotional sphere (1939). Word-association tests showed a reaction time varying between 1–5 seconds, with an average of 3 seconds. Most of his replies could be grouped in the general concept, contrast, similarity and personal

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categories. Words which carried significance to him in association with his personal problems provoked constantly an affective storm. He became restless, flushed in the face, and his facial tensions and postures altered quickly and with ease. Explanations of his reactions were offered very readily and the material gleaned served to aid him in solving his problems. All of his replies were relevant, coherent, and intelligent.

During the interviews his emotional states appeared to be very fluid. Frowning, wrinkling of the brow, varying play of circumoral muscles, a changing lustre of the eyes, flushing, blotching of the face and neck, alterations in respirations and in the pulse rate, desires to urinate and defecate, sweating, etc., all were present and appeared in a congruous and appropriate setting. He evinced much interest and enthusiasm in the investigation of his life and seemed willing to accept advice. His general bodily posture altered in harmony with the prevailing affect. His vasomotor reactions were consonant with the amount of emotional loading of the various questions. This patient was given insulin and he reacted very well, so that he was discharged as recovered. The word-association test was repeated after his insulin treatments, and it showed a general speeding up of the reaction times with the same amount of affective responses.

Here, then, is a patient who seems to conform to a picture of paranoid schizophrenia but who manifested a tremendous amount of affect wholly in harmony with cognition and conation. He showed good insight in time and no incoherence. He exhibited certain prepsychotic personality traits which have been associated with schizophrenia. This man represents in all probability a complexly determined state of the katathymic variety of Wertham. His sexual ruminations soon began to direct his conduct and his behaviour suffered. There was no apathy, indifference, blunting of the emotions or gradual deterioration of the affect. He still had much of what has been termed *élan vital* and his energy retention aided him to recovery. Insulin hastened probably what would have occurred at a slower pace. Bleuler (1934) stated: "Therefore one cannot speak sometimes of simple indifference, because there exists a plain fundamental mood of euphoria or depression or fear. The general attitude is 'I don't care,' sometimes purely so, and at times with a depressive or especially with a euphoric colouring." Bleuler mentions that melancholic and manic states often constitute the first manifest syndrome of the disease, but stated that they may appear later on in the course. Sullivan remarked as follows in *Affective Experience in Early Schizophrenia* (1925): "Patients report that they have been unhappy for a long time before the appearance of frank schizophrenic symptoms. Many of them feel, think and are dominated by impulses arising from what may be called a content of personal inadequacy or one of personal indifference and peculiarity. The affective contents are generally intensely unpleasant. At no time has anyone in this condition reported to the examiner a single thing that would justify the assumption that his affective state stood in other than the most simple and commonplace relation to this content." He continued: "Both from crude observation and from detailed study of the facial expression, the indifference, apathy, and emotional disharmony of the schizophrenic patient are more a matter of impression than a correct evaluation of the inner experience of the patient." Clinicians have probably been aware of this changing opinion on the affect status in these patients, but the old Kraepelinian theories continue to hold sway in many sections of this world.

Masturbation rumination seemed to be the initial locus of this patient, with attendant depressive, inadequate and self-accusatory ideas. In the case-records to follow this problem will be found quite common. Kasanin mentioned the frequency of this problem in his cases of schizo-affective psychoses (1933). This patient bears out Beck's opinion, based on the Rorschach responses that the schizophrenic as compared to the control has "not less ('shallow') but more affect." Beck (1938) further states: "The present Rorschach findings here strikingly add to the evidence that has been gathering as to the strength of the affective factor in the schizophrenic personality."

The next patient represents that type of mental disorder which seems to occur in response to a physical illness, operation or trauma, but is in reality a climax to an intrapersonal struggle that has been raging for some time.

CASE 2.—*Summary:* Female, aged 23, single, domestic, had ideas of reference, felt accused of stealing, became confused, hallucinated, had delusions of marriage and pregnancy. Previous episode six months before, following a mastoidectomy. Anxiety over forthcoming marriage, depressed, anxious; gradual improvement; no shock therapy.

J. S—, female, aged 23, single, domestic, was admitted to hospital in December, 1938, because she showed a confusional state in which she fancied she was married to her surgeon and thought that she had become pregnant by him. Upon admission she was agitated, tearful and depressed because she felt so miserable, not having been informed when she was to have her baby. She conversed relevantly, coherently, and rationally, but she was unshaken in her belief of her pregnancy. Her family background exhibited a father who was a chronic alcoholic, a syphilitic, and a most domineering and disagreeable person in the household. The mother was likewise syphilitic, but she was meek, mild, and emotionally unstable. The patient was an only child and had formed a close attachment to her mother. She was described as a very shy, timid, backward, sensitive, suspicious, serious-minded person. She was devoid of humour and never

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could accept practical jokes. She was extremely religious and entertained very high ideals. She had never smoked, and drinking was very sinful. She left school at 14 and went into service at once, being considered very faithful and efficient because conscientiousness had ever been her watchword. Foreboding and worry always accompanied the solution of her difficulties. Socially she mixed poorly and had very few friends. She had been courting with a young man who was described as a very fine chap, and had been engaged to him for six months. The wedding was planned for the month she entered the hospital. It was felt by the mother that the patient had never really accepted this man, but felt that it was her last chance. Imaginations of a much better marriage had occupied her mind for some time. In April, 1938, she underwent a mastoidectomy, being very ill and delirious for a few days after the operation. In this delirious state and for a week after its cessation she phantasied she was married to the surgeon who operated upon her, that she was pregnant by him, and that he was going to instruct her into the mysteries of marital union. She was said to have been quite silly and "gushy" in her attitude. These ideas finally dissipated and she was discharged. She was left with a dispositional alteration that consisted of a marked withdrawal from life. She became very quiet and spoke only when spoken to. At times she stared into space and seemed to be thoughful. Soon she developed the idea that store clerks were watching her and followed her, thinking that she "lifted" certain articles. Then, this suspicious trend spread to include many other persons. As the marriage date approached she became more seclusive and suspicious, and this event was postponed. A week before admission to Jordanburn she developed a "head cold" and a few days later vomited, ran a slight fever and had an earache on the same side as the previous operation. Because of the possibility of a recurrence of the old mastoid infection, she was readmitted to the same hospital for observation. This did not eventuate and the symptoms receded. Upon the third day of hospital residence, with no toxic manifestations present, she began to distort the outer world by believing that a huge play was being presented, the stage being the hospital ward and the actors and actresses being the nurses, doctors, attendants, etc. She was the principal actor in this play, which revolved around marriage, sexual relations, pregnancy, divorce, etc. Because of her refusal to remain in bed and her insistence of posing and acting in the ward she was transferred to Jordanburn Nerve Hospital.

Upon admission she was still confused, believed that she was still acting in the play, thought she was pregnant and asked for the surgeon. Her first question was, "When am I going to have my baby?" She was most apprehensive and yet appeared depressed. She stated that the surgeon had promised he would return to instruct her in the technique of marital relations and during this remark she appeared ecstatic, with a radiant smile upon her face. During the first few days she continued to misidentify persons and places, but gradually this state cleared. Her physical and neurological examinations were negative. The laboratory examinations were negative, including the spinal fluid Wassermann and colloidal gold determinations. She was of the asthenic type and had always had a sickly appearance.

During many psychiatric interviews she appeared very depressed, agitated and tense. She continued to believe she was married and she defended these views with much affect. She stated that she had always felt inferior to her few girl friends because of the location of her home in a poor section of the town. One of her girl friends married a man who was a "superior person" and this patient dwelt much on her lot. She phantasied about marrying a man in a higher social position than her fiancé, and as her wedding approached she began to worry about marital life, sexual relations, pregnancy, etc. After admission to hospital she became confused and felt she was living in a world of ecstasy. She stated that she had been emotionally upset for some time and had been most uncomfortable. During interviews her facial postures were those of sorrow, pain and much displeasure. Her general bodily postures were altered in accordance with her prevailing feeling tone and seemed co-ordinate. She covered her face when she cried and appeared much distressed. On two occasions she bolted from the room when she became tearful and agitated while discussing her home, her parents and her marriage plans. Her vasomotor reactions were very prominent and adequate and consisted of blotching of the neck, tearing, blushing, sweating, alteration in her respirations and pulse, and much rumbling of her intestines. She conversed coherently, rationally, and relevantly about her personal problems. Word-association tests showed a reaction time varying between 3–35 seconds, with an average of 10 seconds. Most of her replies were grouped in the general concept, personal and contrast groups. All those words which referred to her phantasies and pre-occupations caused much affective alteration, which was labile, deep, appropriate and adequate. Up till the time of discharge this patient exhibited a powerful affective response. She received no shock therapy and was discharged as much improved.

This probably represents a paranoid type of reaction, with phantasy and wish-fulfilment in the foreground. This girl's background was not of the best at any rate and she reacted strongly to references to her home situation. Emotionally she probably was immature and her immediate reaction to her girl friend's marriage was mild jealousy and much wishful thinking. She was able to have her wish fulfilled by experiencing all those hoped-for events in a dream-like mental state after her first operation. The recurrence of the state during the second hospital admission seemed to assert that her difficulties had not as yet been resolved. The toxic factors played a part in her first hospital dream state, but they only served to crystallize those ever-present longings. This girl's affect remained good and there was no incongruity between ideation and affect. The setting was one of clouding of the consciousness, which gradually cleared. The

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prognosis seemed to be relatively good. Once again the words of Sullivan should be remembered relative to the preservation of affect in these patients. This girl was miserable for many months, but she seemed to have the capacity to exteriorize her feelings more than many of these patients can do. She represents a type of schizophrenia which shows good retention of affect.

This next case-record records that type of person who has developed rigid somatic delusions which have altered his life and which he defends most vociferously with much affective show.

CASE 3.—*Summary:* Male, aged 23, single, unemployed, admitted because he was depressed, agitated, tearful; kept to his bed, and considered death to be imminent. For two years very hypochondriacal; many somatic delusions. Kyphosis caused him shame, ridicule and feelings of inadequacy. Masturbation for seven years. In hospital, depressed, tearful, no insight, oriented, relevant and coherent; poor reasoning. Believed brain was draining from penis, etc. Much affective turmoil. Cardiazol with moderate improvement.

R. R—, aged 23, male, single, unemployed, was admitted to hospital in January, 1938, because he had become agitated, depressed, tearful, and difficult to feed and to manage at home. Upon admission he conversed readily, relevantly, coherently and with evidence of much tension, depression and restlessness. His family background was studded with insanity for three previous generations on the father's side. The father was a quick, anxious, impulsive and irritable man, who dominated his weak, passive, cringing wife. The patient's two sisters were retiring, shy, and were labelled as "home girls."

The patient had been shy, timid. lacking in self confidence, suspicious, a model child, a poor social mixer and an avid and omnivorous book-reader. The early kyphosis and cardiac illness helped to turn him from his social milieu and to increase his phantasy life. His school history was satisfactory, and at the leaving age of 14 his father decided he was too weak to work and that he should help at home. His social and sexual interests remained immature. Masturbation, begun at 16 years, had remained the central focus for his pre-occupations and he gradually developed many somatic delusions. He believed that masturbation was the only cause for his troubles and this belief he would defend strongly. Ideas of reference soon developed into paranoid constellations, and then he began to feel that his food was being poisoned at his home because his parents wanted to "be rid of such a rotter as me." He believed that he was going to die to-morrow and kept asking where he was going to be buried. During this psychopathogenesis he retained his agitation, episodes of marked depression and irritability. In hospital, examination elicited a moderate upper dorsal kyphosis and an apical diastolic murmur. The laboratory tests were negative. Mental examination revealed agitation, restlessness, seclusiveness, depression, tension, many somatic delusions revolving around his brain and his genitalia. He believed he had "softening of the brain" due to masturbation. Machines in the ceiling by means of electricity influenced his mind and this belief was stoutly defended. The nurses and attendants spied on him all night. The machines influenced and "worked on" his genitals. His most persistent question was, "When are you going to bury me? Why do you postpone the misery? You know that I am going to die to-night and that you are going to bury me in the yard next to my bed." Usually, the patient sobbed, with much shaking of the body, reddening of the eyes, and expressed accusations against the physician, calling him a liar because he was not telling him the truth about the evil effects of masturbation, whenever he asked the above questions. At times he became belligerent and often adopted a threatening attitude. His actions betrayed suspiciousness of the physician, as he followed furtively the every action of the physician. His predominating affective states were those of fear, anxiousness, depression and anger. His sensorium was clear, judgment was poor, and insight was lacking. During many interviews he told of his difficulties of adjusting at an early age. His playmates ridiculed him as a "hunchback." Constant taunting along these lines together with his basic insecurity "drove me into my home, where I stayed." He disliked being on the street or in public, for he believed people talked of him. The masturbatory problem increased his seclusiveness as he thought everyone could tell by his facial appearances that he masturbated. As this developing process was continuing he began to feel sorry for his parents, as he believed that he was causing his mother untold misery. He became very hypochondriacal and referred to himself every reference in any newspaper, book or magazine to any disease. Soon he became convinced he had syphilis, softening of the brain, etc. He took to his bed because he knew that he was to die. The affective turmoil which he manifested during the interviews seemed to be expressed adequately. His facial expressions were consonant always with the affective state he was exhibiting and with his ideational processes. Grimacing never occurred. He reacted violently to his depressive ideas, and states of affect seemed to be labile, deep, appropriate, adequate and fluid.

Word-association tests elicited marked reactions. To the word "sickness" he replied, after five seconds, "death"—and with this word he shuddered, his eyelids fluttered, he clasped his hands together and became rigid, tears streamed down his face, which was flushed, and there was much perioral and orbital twitching. Disgust with sneering registered next. He gradually became more stable emotionally with the next few words, but with the word "comfort" he responded with "house." He then said, "My own house—you know I will never see it again. All you

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doctors lie, for I have syphilis and brain softening, and you know it." He sobbed very heavily. These examples illustrate in general his reactions to certain key words. No one reply was bizarre or unexplainable, but each could be grouped in the personal or general concept group. The gamut of the affects seemed to have been played during this test.

Here we have a young man who presented primarily a perplexed state. He was still reacting very strongly to many of his depressive ideas. His affective reservoir seemed to be full and could be tapped at will. There were marked depressive trends, with a predominance of death ideas. His prepsychotic personality and his presenting symptoms would seem to make a diagnosis of schizophrenia tenable. Despite his delusions, his personality remained integrated, though a paranoid trend was present. Muncie (1940) has stated: "A peculiar affective change is almost always present. This varies from the lack of wholehearted sympathetic attention normally expected in conversation, with the appearance of abstraction, division of interest, and shallowness, to affect congruous with the patient's peculiar content, which cannot be shared by the observer, or to actual affective incongruity with the content of the moment. The lack of emotional warmth, a dulling or shallowness are the early tell-tale features." On the contrary, this patient was much absorbed in discussions pertaining to him, and his affect seemed warm and deep. He received ten injections of cardiazol, with a marked lessening of his anxiety. Gradually his delusions began to be resolved, his conduct more predictable and his depression less profound. One wonders if he would not have responded spontaneously and if the cardiazol hastened the process. He is still in residence, with no deterioration, and is being discharged shortly.

CASE 4.—*Summary:* Female, aged 29, single, admitted following an attempted suicide. Complained of hypnotic influence, ideas of reference, beliefs that life was futile. Gradual personality alterations, conduct disturbances, and ecstatic states alternating with depressive states. In hospital two years. No deterioration. No specific therapy. Gradual improvement.

M. L—, female, aged 29, single, school teacher, was admitted to hospital in December, 1937, and is still in residence. Following an unsuccessful attempt to drown herself, she was brought to hospital in a confused state. Her family was described as "very schizophrenic," as the parents, two brothers and one sister were queer, asocial, bizarre, idealistic, and extremely religious. Up to the age of 8 she was very aggressive and outgoing, but then became shy, timid, introspective, and developed fear of most persons. Intense inferiority feelings and self-consciousness developed. To conflicts she reacted with sullenness and silence. Dependence on her elder sister, who was a physician, emphasized her impotences. Heterosexual interest never was acquired. During her University life she lived alone and had very few friends. For seven years following graduation she taught in various schools, changing her position frequently because there always seemed to be environmental frictions. Three years before admission, at 26 years, she became suspicious of her colleagues, thought they were talking of her, remarking about her face, believed the headmaster was in love with her and was signalling her by mysterious codes. She experienced many changing delusions of her soma, thinking one day that the lower part of the face was paralysed, calling for vigorous exercises, and at another time believing her nose was too long, etc. She stated, "There has been a change in my speech the last two years. I could not speak without a feeling of constriction in my throat, so I became fearful, miserable and anxious, and did not care to associate with people. I stored it all up and repressed it." Just before admission she visited the Continent, when she became confused, hallucinated and deluded. "I packed some newspapers in my bag, and I knew that the Nazis followed me all over and I became panicky. I had my picture taken on an ass called Felix, and thereafter everyone called me Felix, and I heard voices calling me Felix in the Paris subways, in the Louvre, in the trains. I was under a hypnotic influence—under a sinister and malign veil. When I thought of anything this voice would inject a sinister comment and create an Ibsen atmosphere. The voice would say, 'You are a snake charmer's daughter.' I was terribly flippant to God and I grew to fear Him." In this confused state she returned to Scotland and attempted to drown herself in the sea.

Upon admission the predominating picture was depression and confusion. Speech and motor activity were moderately retarded. She appeared depressed, was co-operative and her general attitude was good. Orientation, memory, and general information seemed adequate, and she conversed rationally and coherently. She felt that she had a physical illness, but she stated, "I bottled up my emotions rather than appear grotesque and then I found out that I had a double feeling." Word-association tests produced an average reaction time and responses of the personal, general concept, contrast and similarity categories. No bizarre responses were given. At first she remained quiet, but as the test progressed she became more restless, tapped her feet on the floor, shifted her position and finally closed her eyes. Restlessness first appeared with the stimulus word "man." Her reply was "girl." Biting of finger-nails continued during the test, and on two occasions flushing was noticed. A second test revealed again restlessness and affective unrest. To the word "war" which was interpolated, she flushed, wept and finally sobbed profusely, and remarked that the international situation was painful to her. She explained that only rarely was she able to express her affect outwardly, despite a most intense subjective affective experience, and said, "Something holds me back when I want to cry or laugh, but I feel all these emotions inside me." During interviews she retained the basic

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affect of depression, and talking was difficult for her. Facial expressions and bodily postures were always consonant with her affect. "How can one laugh in a place like this?" was her comment to a query as to her reactions to being in hospital. For many years before admission she suffered intensely from personality maladjustments and was herself acutely aware of them. The acute psychotic episode developed after a prolonged period of failure of adjusting. She passed through transitory excitable hallucinatory periods, trance-like states, and definite paranoid phases. Affect has been maintained during her illness and seems to be present in good quality and quantity at present. One may doubt her future and one may wonder how far she will deteriorate, but she still shows adequate, labile, deep and appropriate affect. She has not received any "shock therapy" but has improved slightly.

CASE 5.—*Summary:* Male, aged 33, single, admitted because of excitable peculiar behaviour. Depressed for two years. Guilty feelings about his hatred for his father. Affianced four weeks before admission, with attendant anxieties over marital sexual problems and worry over masturbation. Much sexual talk, increased paternal affection; believed himself the cause of the world's troubles; felt he should be tortured to death; became confused, excitable and then stuporous. Cardiazol with recovery.

T. F—, male, aged 33, single, window-dresser, came from a family that seemed well adjusted. He had always been a shy, sensitive, sympathetic man, with much good-heartedness. Having attained average grades, he left school at 17 years and went into a department store as a clerk. He made few friends and never associated with the female sex. Failures or/and disappointments usually caused mild depressions for a few days. After about six years in a departmental store he spent two years in a Trinidad office, but was very unhappy because of failure to advance. He returned to Edinburgh and became a window-dresser being considered efficient. Suspiciousness of his employer developed soon because he thought that his advancement was being retarded, the reason given being his firm belief that his employer knew about his frequent masturbation. Anxiety was always prominent, together with many guilt feelings which revolved around the masturbatory conflict. Shortly before admission he expressed himself as follows: "I must pay for this sin now before I marry. If my fiancée ever finds this out I am done for." He felt that he had not treated his father in a conventional filial fashion and now thought he should atone for it, and he said in part, "I must make it up to my father for I have not treated him right." He began to be inordinately affectionate to his father. He indulged in much loose sex talk with the other store employees and began to act in a perplexed, confused and odd fashion. On the day of admission he acted very strangely in the store and soon left it to be found talking in a rambling style in a nearby pub. He was taken home, but he became unmanageable and was later admitted to hospital. The father felt that the onset was rather sudden, because he had not noticed anything awry until a few days before admission.

Physical and neurological examinations were negative, as were the laboratory tests. On admission he was confused, restless, and had a most anxiously depressed facial appearance. He talked to imaginary people and misidentified constantly. He implored God's aid unceasingly, saying: "I have committed every sin on this earth; let me burn in Hell. I am responsible for all the sins of the world. I know I have V.D. from that dirty filthy habit of mine." He thought at times that he was actually in hell. Suspiciousness was also prominent on admission. During the first few days he was actively suicidal, refused food, retained urine and faeces, tried persistently to drown himself by placing his head in the toilet bowl, held his genitals constantly, scratched himself unremittingly and was very agitated. He was mute for three days. Then he spoke only a few words and soon he talked on his sin in a low voice. He obeyed the voices which told him to do everything. The wireless influenced his conduct and thinking. He was especially concerned over the welfare of his parents. This clinical state cleared, but his depression and suspiciousness remained. He became oriented and was able to discuss his illness quite frankly. As stated above, he had a number of worries, and when he consulted his friends about the technique of sexual relations he became very happy. So many thoughts impinged on him that he decided to take to his bed to solve them. He said that he knew he was becoming confused. During many talks with him he was depressed and he sobbed often, stating among other things, "I am guilty about the terrible ways of sowing foolishly my seed and I am going to repent, and I want to burn dearly for the worry I have caused my dear father." Emotionally loaded questions caused much sighing, sobbing and agitation. He claimed to be miserable when discussing his personal problems. Tremors appeared around his mouth when he tried to talk, and his body shook.

Word-association tests showed a reaction time between 2–30 seconds, with an average of about 11 seconds. His replies were coloured by his guilt feeling, and were mostly personal. Respirations altered, postures shifted, nail-biting was engaged in, and sweating and flushing occurred. He felt he had been reincarnated. "I feel that I am the devil himself. Everything points to the fact that I'm guilty. There are a lot of men here who have suffered and I feel that I haven't cared for them." To the word "man" he replied, "beast," and said, "I'm wrong there in saying that; maybe it was the way I had been behaving, for I have been taking food that did not belong to me." The word "wish" brought forth the response "desire" and the statement, "I desire a bed, a home, love and my father." Because his depressive features lingered on he was given six injections of cardiazol, and the effect was dramatic.

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He became cheerful, pleasant, lost his depressive and suicidal trends and ideas, and felt that he could cope with his problems. He realized he had been mentally ill and accepted and discussed suggestions.

Here is a young man who manifested a stuporous reaction at first. A state of perplexity, confusion, and agitation preceded the acute illness, together with an affect of depression and suicidal trends. Once again we see rumination over masturbation as the hub of his difficulties, and from there in all directions diffused other trends. The conflict between primitive appetites and social dictates flared openly when he became engaged. His personality structure tended to be unbalanced by lack of average drives towards certain goals and an accentuation of others. In his stuporous state he showed intense affect and at no time was there apathy. Negativism and resistance were minimal. His main ideational content was about death, his desire to burn, and his wish to be scourged for his sins. However, a rebirth *motif* was also present at times, and it would seem that he had not decided which states he desired. His features did not resemble a benign stupor in many respects. He remembered most of what occurred in his acute state. According to Darrah (1940) this patient might be considered as belonging to the schizophrenic group. Fundamentally, he represents a typical confusional state with complex determined ideas and a sense of guilt that was in the ascendant.

The next case-record illustrates that person who has been well adjusted up to the episode of acute confusion, and who develops this reaction in response to what seems to be an overwhelming challenge to one's ability to cope with environmental factors that threaten one's personality structure. Paranoid trends were prominent and were intimately related to her personal problems. She passed through a stuporous phase also in the early phases of her illness, and later became slightly euphoric.

CASE 6.—*Summary:* Female, aged 20, single, nurse, showed a confused state, with ideas of illegitimate pregnancy, stupidity, infestation with scabies, dirt and inefficiency. Previously confused, depressed, deluded and hallucinatory episode a year before. Following two missed menstrual periods she developed ideas of guilt, reference, sin, and became anxious and restless. Misidentified persons, was disoriented, agitated, and saw "visions." Mute for two weeks and stuporous. Gradual recovery with a sequela of depression, which cleared with cardiazol injections. Hypomanic state transitorily occurred following cardiazol. Discharged recovered.

M. C—, aged 20, single, had been employed as a psychiatric nurse at hospital for four months before she began to show signs of mental difficulty. She had come from Ireland, where she had worked in hospital for two years. Her family background showed that she was the twelfth of eighteen children; that she lived in an isolated country region with no social contacts; that her family seemed to be a cheerful lot, being described as happy, well adjusted and extravertive. There was no history of nervous or mental illness.

Our patient had been an open, cheery sort, who had taken her nursing work seriously. She was most sociable and had many girl friends, but never any men friends. She left school at 18 and her home because she felt there was no future for her in the country. She entered a hospital to train for nursing, but because of her violent dislike of her Irish matron, whom she labelled as "autocratic" she developed a reaction which was characterized by confusion, hallucinations, delusions, restlessness, apprehension, disorientation and misidentification. She thought she had tuberculosis at this time, though all examinations were negative. In two months this picture cleared and she returned to work. Soon she came to Scotland to work. As a nurse she was efficient, considerate and understanding. Socially she adjusted well, though she never associated with men. Her ideals remained high in her work and daily living. She missed two menstrual periods and became anxious and mildly panicky. In this anxious state one of her nurse friends, in jesting, suggested pregnancy, and the patient accepted this seriously and reacted violently. She believed she had sinned, that all knew of her "fall," that she was guilty of many wrongdoings, that Scotland Yard would soon pick her up, that people talked of her low character and were watching her. She glossed over the fact of the absence of sexual relations. She caught herself doing what she termed "odd" things during the course of her daily work, and this reinforced her belief that she was "daft."

Physical and neurological examinations were negative, as were the laboratory tests. She was of the pyknic type.

Her own story brought out the tremendous affective storm which she experienced before she finally succumbed. Fear of detection and worry that her reputation had been besmirched were uppermost in her mind in her acute episode. Her facial and bodily attitudes left nothing to be imagined as to the affective turmoil which she was experiencing. Word-association tests revealed an average reaction time with an average type of response words. A few words brought forth a prolonged reaction time, such as kiss, insult, marry, baby, pray and sick—all words that referred intensely to her personal interests. To these she blushed, became restless, cried and appeared upset. Respirations and the pulse-rate were increased. Affective rapport seemed easily established. She gradually recovered to a certain level, but there was still an element of depression and doubt left. She was given five cardiazol injections, after which she became

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slightly more hyperactive, more elated, and lost her doubts and paranoid ideas. In a few weeks, however, she reverted to her usual personality pattern and was discharged as recovered.

This girl was in a turmoil state when she was first seen, and many of her symptoms had the schizophrenic imprint. She had wished for closer heterosexual relationships, but she had always been deterred by her strong idealism and religious training. When the idea of an illegitimate pregnancy was offered to her, even in jest, her super-ego proved to be too stern a taskmaster, and in the personal conflict that raged subsequently she finally succumbed. Even though she had an open and cheerful personality, when environmental stresses became too strong, she was not able to resolve her difficulties. Emotionally she was immature and reacted at times with childlike patterns. Her paranoid trends were very intense in her psychotic period and took the form of individuals seeking her out to force her to atone for her social misdemeanours. There were points that pointed to a diagnosis of manic-depressive psychosis, but we felt that her general reaction pattern was more akin to schizophrenia, though not typically so. Her behaviour was certainly completely determined. Her libido had been discharging into her rich phantasy life, but during this interpersonal crisis it was being severely repressed. Throughout her entire illness she maintained what seemed to be a deep, appropriate, adequate and labile affect. There were also elements which might make one consider a diagnosis of schizo-affective disorder. The latter impression stands a possibility of being used in the borderline patients too often, although it has some merit.

This next patient represents another example of a person who ruminated over masturbation, then became confused, then stuporous, and developed a train of accessory symptoms which were indicative of a profound personality disorder, and yet maintained his affective tension at a good level and finally attained a social recovery.

CASE 7.—*Summary:* Male, aged 21, single, salesman, exhibited strange conduct, such as remaining in bed, refusing to eat, thought people were talking of him, saw strange objects and was obscene. Well adjusted socially, vocationally, but not sexually. Vain and proud. Masturbatory worries. Following domestic incident developed ideas of reference, influence, and inadequacy and above symptoms. Hospital five years; no deterioration; good environmental interests; retention of affect. Insulin; social recovery.

G. N—, aged 21, single, salesman, was admitted to hospital in 1934. The family history revealed no trace of nervous or mental illnesses; the siblings were well adjusted and his home life was happy. He had tended to be introspective, shy, timid, and did poorly as a salesman. Sensitiveness caused much discomfort at times. Since 14 years of age he had ruminated over masturbation and at admission this seemed to be the focal point of his anxiety and depression. He believed his employer knew of his "weakness" and had delayed his promotion for this reason. Soon he felt that people said derogatory remarks about him and confusion resulted. He became excited, then depressed, and felt he should die, choosing starvation as his method.

The physical and neurological examinations were essentially negative, as were the laboratory tests. He was of the tall, asthenic type.

At first he was in a semi-stuporous state, had to be tube-fed at times, and was preoccupied with death ideas. He appeared to be most depressed. After a few days of such behaviour he emerged to become rather seclusive, aloof and shy. During interviews he appeared to be most anxious to analyse the genesis of his illness, spoke freely of his sexual ruminations, his ideas of persecution and his death ideas. His affect remained adequate and appropriate, he being very interested, curious and pleased that he could aid. He was always very calm, quiet and placid, and worked well on the hall of his residence. His orientation, memory, general information, retention and recall were within normal limits. All of the usual physical accompaniments of the various affective states were present. Enthusiasm ran high for the future and he was anxious to apply advice. Word-association tests revealed a reaction time of 8 seconds as an average. The stimuli words brought forth varied affective responses, which were adequate and harmonious and which helped to solve underlying difficulties. Many of his replies were grouped in the general and contrast categories, but there was a definite trend to add a suffix to the stimulus word and create a new word, such as "house-top" in reply to "house," "chop" in reply to "mutton," "writing" in reply to "hand," "hand" in reply to "short," "running" in reply to "smooth." These replies probably signify that attention was low at that time. He received insulin and gradually gained sufficient ground to be considered for discharge.

Here we have a young man who led a rather restricted and constricted earlier life, dwelt much in phantasy, and ruminated over masturbation. In hospital he exhibited adequate affect, qualitatively and quantitatively, and there has been no intellectual deterioration from gross observations. Possibly to observers his calm, placid face and his bodily attitudes would lend the impression that his emotions were affected adversely. As Hinsie (1930) has remarked, "Socially he is emotionally impoverished; personally he is not. The libido has been conserved and displaced." In the earlier stages his libido was attached to his phantasies and his fears, but in hospital it has been redirected to external objects. Further on Hinsie says:

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"Concretely, then, we claim that among the thoroughly communicative schizophrenic patients that we have studied intensely and extensively, emotional deterioration has been only apparent, not real. Indeed, there has been no measurable loss of emotional capacity. What has actually happened is a withdrawal of emotional interests from environmental situations and a subsequent reassembling of the receded emotions. The latter are then delegated to the service of the psychophysical self." Hinsie felt "that there has been merely a reapportionment of emotional values, a redistribution of the emotional content." Later on he declares: "It will be seen that after treatment the patients were able to reinvest their emotional capacities in environmental matters. It must be granted, then, that there was no actual deterioration of the capacity to exhibit emotions. The latter were only diverted from their everyday manners of expression. I am sure that all of us have seen this type of patient with a schizophrenic reaction, that is, one who still has a great deal of affect preserved and who is still using it in channels other than most of us are familiar with. Often, as Bleuler noted, this affect will flare out into the open when the complexes involved are touched off. This young man constituted the typical shut-in sensitive, asocial personality in which the schizophrenic process takes root. Masturbatory worry and anxiety again was prominent. He was socially and emotionally immature and his environmental reactions were adolescent. He reacted to his problems by extreme withdrawal so much so that his admission state resembled a "partial benign stupor reaction" of Hoch (1921). Throughout these years he has steadily improved and insulin seems to have hastened his recovery. Death ideas were prominent. He probably represents a recovered catatonic state with paranoid colouring and depressive features.

The next case-record is that of a young man who developed a stuporous reaction in response to masturbatory anxieties with attendant accessory symptoms, and who was aided by cardiazol.

CASE 8.—*Summary:* Male, aged 21, single, medical student, admitted because of negativistic reactions, such as refusing to sit examinations, to leave his bed, to eat; developed ideas of reference and persecution; believed he had committed the greatest sin of all times by masturbating. Hallucinated, became depressed, felt inferior. Shy, timid, poor mixer; agitated, tearful, embittered and defended beliefs stoutly. Cardiazol, with return of confidence and dissipation of beliefs. Affect active and retained.

A. L—, male, aged 21, single, medical student, was admitted to hospital because of peculiar conduct and ideas, which had developed over a period of three to four years. His family background demonstrated a well-adjusted group, with no psychopathic or psychotic trends. He had always been retiring, modest and a poor mixer, never having associated with the female sex, but he had indulged in much daydreaming for years, the content of which was always sexually tinged and led ultimately to masturbation. As a student in his premedical university days he always stood second in his class, being excelled usually by a girl student, who coincidently is the subject of the next case-record. The young man's scholastic record began to suffer four years before admission, when he began to worry over masturbation. At this time he was riding to school on a bus when he espied a girl classmate, and his reaction was an erection with seminal emission. His anxiety was terrific, as this was a new experience to him and he thought that he was either diseased or had been wounded. In class that day his anxiety mounted to a degree so that he had to excuse himself from class and repair to the lavatory. He examined himself, and this process was watched by some of his classmates, who twitted him. This shocked him intensely, and for two days he remained home in bed, fearing to return to school. Very soon after he voluntarily masturbated, and henceforth this was repeated regularly with tremendous anxiety, reproach, shame, and a feeling of disgust. He read that "softening of the brain" resulted from such a habit, and he began to introspect and watch for symptoms. One of his brothers, who was a physician, reassured him, but our patient refused to accept the logical explanation offered. His religious tenets came into direct conflict with his primitive appetites. The acceptance of the latter reinforced his belief that an affection of the brain was occurring, because he reasoned that if he were not heeding his religious beliefs his moral life was weakening. Voices soon called him "masturbator," and he knew that people on the street whispered to each other as he passed that he was a great sinner. He became depressed, agitated, lost his appetite, and interest in living, and tried to stay awake at night, believing that if he fell asleep he would lose everything in his head. He preferred to remain home, finally in bed, and refused to sit his examinations. "The whole world knew I was an inferior person and would never succeed because I had masturbated. I hear everybody calling me that name as I pass by. It's no use; I am lost and I'll burn in hell now for no one can save me." Some such remarks were repeated daily with much conviction and affect displayed, amounting almost to a belligerent attitude if his beliefs were questioned.

His physical and neurological examinations and laboratory data were negative. He was of the athletic type. He was well oriented, conversed coherently, spontaneously, and always with much play of affect. At first he presented a stuporous reaction, had to be fed, clothed, and cared for, and was mute for a few days. Soon interest in the environment developed and a not unusual type of conduct obtained, save only for a tendency to seclusiveness and quietness. His

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predominant affect was depression with agitation appearing in emotionally loaded conversations. Interviews were always stormy, as the patient resented any effort to discount his beliefs. He defended them from all frontal and flank attacks. He was ostracized and his body ruined, and so why live? Interviews ended in the patient trembling, crying, and his lips, hands and body stiffening. He described the horrors of his affective life that he experienced in his fight with his "sin." No one with any affective deterioration could have suffered the way he confessed he had. There was no flattening or apathy during his description. Word-association tests showed an average reaction time of 9 seconds, certainly a delay, and signifying much affect attached to his passing thoughts. Most of his replies were segregated in the personal and contrast categories. Any words referring even remotely to sexual matters were followed by prolonged reaction times and much play of facial postures, tearing, restlessness, alterations in respiration, pulse, sweating, and a desire to urinate. There was scowling, wrinkling of the forehead, blotching of the neck, etc. His physical accompaniments harmonized with his subjective feelings. After five cardiazol injections his depression lifted, his beliefs vanished, and confidence was restored. Six months after discharge he was bright and cheery, his internal problems were solved and he was planning on returning to medical school in the fall.

Masturbation and its concomitant mental upheaval again proved the spark with this patient. A stuporous state again was present with death ideas in the ascendancy. The capacity to modulate his affects certainly was preserved. The many disturbances of affectivity that Bleuler described were lacking, but the prepsychotic personality, the long duration of the process, the contents of the delusions and hallucinations and the refusal of the patient to accept explanations led us to believe we were dealing with a schizophrenic reaction with affect retention. Phantasy loomed large in his life, and he had ceased his sexual development at the autoerotic level. Guilt feelings were painful, and soon projection caused the development of ideas of reference. From a social viewpoint he was a failure, and with the help of psychotherapy and cardiazol he has returned to society. Cardiazol hastened his recovery.

The next case-record is that of the counterpart of the above case, in that she attended the same school and always stood just ahead of the above patient and developed a somewhat similar psychosis. Her history illustrates the potency of family frictions in personality development.

CASE 9.—*Summary:* Female, aged 20, single, medical student, admitted because of disorderly conduct, excitability, confusion, a stuporous state and paranoid trends. Paranoid family background with domestic combustions. Unresolved oedipus complex. Ideas of reference, delusions, hallucinations, confusion, etc. Mute in hospital, rigid postures; gradual return of interest. Recovery; good affect. Readmission three months later with recovery and no affective scarring. Cardiazol.

E. B—, female, aged 20, single, medical student, was admitted to hospital because she had suddenly become confused and acted strangely. The family background showed a mother who was very suspicious about her schoolmaster husband. She believed he was emotionally involved with his school teachers and often would spy on him at school. She created frightful scenes at home and fought with her husband constantly. He was timid, shy and retiring, and was dominated by his more aggressive wife. The patient defended her father and turned against her mother. The paternal uncle was an epileptic in hospital. Our patient had always been a very bright girl scholastically, having always been dux. Timidity, shyness, overconscientiousness, introspection and a worrying nature had been prominent. Socially and sexually she was immature. Preoccupations about her family constricted her thinking and fears developed. Her school work suffered, confusion intervened and she hallucinated. She thought she was a prostitute, that she was in love. She hugged the clock, thought God was in her home, became unmanageable and was admitted.

Her physical, neurological and laboratory examinations were negative. She was of the athletic type. The day after admission she became mute, and remained so for a week, being negativistic, retained her saliva, urine and faeces, and refused food. Gradually she recovered, with good affective retention, illustrated by her attitudes and general behaviour. She discussed her illness intelligently, and it was possible to point out, as Hinsie has suggested, where her emotional stream was sidetracked into a small rivulet and was finally dammed up. Affective rapport seemed strong. Word-association tests showed an average reaction time of 2 seconds with very intelligent replies, mostly of the general concept group. Most interestingly, out of this test, came the revelation that she refused to speak for the first week of admission because she stated that a nurse told her not to talk but to rest her voice. She exhibited all the usual physical alterations during affective expression with no dissociation present. She was discharged as recovered, but in three months she was readmitted in a catatonic state. Her depression was more prominent at this time, and seemed to dissipate quickly with cardiazol. On discharge her affect was well retained, and six months later she was well and was returning to school.

Here is a young girl who probably represents a recurring catatonic state with strong paranoid trends, much confusion and apprehension. Her constitutional endowment and the added home environment proved too much for her, and she took refuge in her phantasy life. This had always

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been very active and had required much repression. Her unresolved oedipus situation aided her development of many fears and persecutory ideas. Fear was dominant and occurred in a state of confusion and depression. This girl, with her affective retention, could be helped materially by sound advice and suggestions. It is interesting that this patient and the one above, who were both leaders scholastically of their classes, should have developed similar psychotic reactions with recovery hastened by cardiazol and with no affective scarring. We were never able to detect apathy, indifference, capriciousness, ambivalence, parathymia, rigidity or "affective dementia."

CASE 10.—*Summary:* Female, aged 20, single, domestic, admitted because of refusal to leave bed, to eat, to speak, or to release her sphincters. Truant at school, shy, retiring, sensitive, she reacted to her domineering, aggressive, sergeant-major type of a father. Forced to work home against her will, she became truant, then mute and resistive. In hospital, mute, resistive, negativistic, fearful, but reacted strongly to emotionally loaded conversations. Cardiazol with recovery and good affect.

L. M—, female, aged 20, single, domestic, was admitted to hospital because she had peculiar conduct, such as refusal to leave her bed, to eat, to speak, to pass her urine or bowels. Shortly after her father had forced her to remain at home against her will to aid her mother she began to be truant at periods. Her father was a former sergeant-major and ruled the house sternly, rigidly and unyielding. Three of his sons had revolted and left home. The mother was the necessary corollary to this type of husband and was meek, mild and submissive. The other siblings were well adjusted and successful. In her new residence she was usually happy. Upon return home after the last truant episode she developed the above symptoms. Amnesia was present for the events of the truant episodes that lasted only a day or so, but for the longer ones she had a good memory.

Her physical and neurological examinations were negative, as were the laboratory data. She was of the athletic type. During the first few weeks she remained in a partial stupor, with her body curled up in the foetal position, and she resisted all attempts to look at her face by keeping the bedclothes over her head. Fear was present on her face during the first few weeks. She was tube-fed often and catheterized at times. Even in this state, whenever the home situation was broached she became restless, blushed, developed blotches on her neck and cried loudly. Soon she reached a stationary level, in which she talked only at times, was depressed, expressed paranoid trends towards her father, and at this juncture she was given five cardiazol injections. These elevated her mood, increased her hopefulness and her activity, but did not decrease her fear of her father. At all times she showed much emotional tension, as depicted by tensing of her body, her lips, flushing agitation, turning her face away from the physician and on two occasions bolting from the room. Her affective expressions were consonant with ideation and dependent on it in both degree and quality. Word-association tests revealed an average reaction time of 8 seconds, which meant that she was still governed by complexes. The replies brought forth much affective display that was harmonious and adequate. Six months later she was adjusting well in a religious home, where she was learning the trades and domestic arts.

This reactive stupor, her general behaviour and prepsychotic make-up seemed to us to represent a schizophrenic type of behaviour. Depression was prominent. This girl reacted violently to emotionally loaded personal topics and her affect withstood the attacks of her morbid process. Again, the role of environmental forces played an important part in causing this girl to react as she did. Her truant episodes were completely determined, and occurred when her emotions had been accumulated for a long time until "the lid blew off." This girl had enough understanding of her illness to refuse to return home.

The above ten cases have been presented rather fully. Although many more cases with affective retention could be presented, only a very few will now be presented very briefly.

CASE 11.—*Summary:* A male, aged 30, single, school teacher, was admitted because he had taken to bed, stared, remained motionless, and expressed ideas that other people's anus and penis were in his mouth, and so he spat constantly. He thought his school colleagues plotted against him and at times he saw strange people in the room. His father was psychotic and his mother was a neurotic. He was always shy, retiring and asocial. Scholastically he led his class and received his Ph.D. degree recently. He had two previous mental illnesses similar to this with full recovery. At 21 he began to think that an anus or/and a penis was in his mouth, and he has always become very agitated, fearful and restless at these times. Soon others knew about him and were talking of him. Sensorium was always clear. He discussed his homosexual trends frankly and showed much affect. He would say with much fervour, "Have I got schizophrenia?" Word-association tests revealed much affect as his replies revolved around his delusions. He received ten cardiazol injections with much improvement.

The next four patients have been ill for a number of years, but still have good affect.

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CASE 12.—*Summary:* A male, aged 35, married, was admitted five years ago because of disordered conduct consisting of impulsive assaultive behaviour, odd postures, remaining in bed, and irritability. In hospital he has remained rigidly flexed, with his head touching his knees. Word-association tests caused him to straighten up and his face lit up when the stimuli words reminded him of home. He cried, laughed appropriately. His face flushed and neck blotched. He seemed to bloom once more for a short time, similar to those patients who develop an acute infection and seem to be quite average temporarily. This person had much inner affect all day long, but his outward appearance certainly did not give that impression.

CASE 13.—*Summary:* A female, aged 37, married, had been in hospital for eight years because of strong persecutory trends towards her employers. She had been also quite depressed. She went through a stuporous phase in hospital, then emerged to continue to be very suspicious. She still has a very active affective response that is visible in ordinary conversation with tearing, laughing, blotching, flushing, and restlessness, all occurring in an appropriate setting. The words given her in the test evoked incoherent, irrelevant replies at times with a labile affect.

CASE 14.—*Summary:* A male, aged 25, single, had been developing a well-organized system of persecutory delusions for eight years, together with auditory hallucinations and ideas of influence. He believed he was a noble personage who was to save Britain. Machines in the ceiling worked on his genitals and caused nocturnal emissions. His affect was one of supercilious anger and irritability, which were in harmony with his ideas. His physical accompaniments certainly were most profuse and deep. No deterioration was present during his hospital stay.

CASE 15.—*Summary:* A female, aged 39, single, had been ill in hospital for nine years because she thought that snakes were in her abdomen, had ideas of grandeur, was suspicious of people, hallucinated and was assaultive. During interviews and word-association tests she was rigid, spoke only occasionally, had many grimaces, with odd postures, but at times words reminding her of home caused blotching, flushing, tearing, restlessness, respiratory alterations, etc. She admitted a great difficulty in expressing herself and knew that her outward manifestations were no mirror of the internal affective situation, primarily because the voices controlled the outward expressions. She showed disharmony at times and at others none. Affective aphasia seemed to be present.

CASE 16.—*Summary:* A male, aged 44, single, had been in hospital for 12 years. Stuporous at first, he is now rather dilapidated intellectually with neologisms, incoherence, etc. But, during the test, his affective reactions seemed labile, deep and adequate when such words as "love," "kiss," and words referring to his family and school positions were mentioned. He flushed, blotched, hung his head, turned his back, cried at times and laughed appropriately. This conduct was complexly determined, and could be brought on at will by those emotional words. Affect still was good.

In the group of patients who showed intellectual dilapidation, moral, ethical and social deterioration with grimacing, posturing, etc., we found that the word tests caused peripheral expression of the affects more often than we had supposed. The presence or absence of the subjective feeling was more difficult to evaluate because of the expressive disturbances. However, when emotionally loaded words were given to them, undoubted outward expressions were noted that were labile, deep, adequate, and harmonious. It is true that at times we could not discern the various types of affect, but could only say that the patient was experiencing pleasantness or unpleasantness. These are only crude sensations, but according to Allport's old theory it signifies action of the parasympathetic and sympathetic systems respectively. As Hunt (1939) stated in the summary of his paper on "Current Approaches to Affectivity," "The organism may either accept or reject a stimulus. This acceptance or rejection is carried out through appropriate bodily adjustments. These reactions are said to constitute the affective responses and are assumed to be a functional entity of some kind." These deteriorated patients are still accepting or rejecting stimuli, and according to our observations are still manifesting affective responses. In many of these deteriorated patients, their responses were neologistic, incoherent, etc., and were couched in a foreign tongue, but the peripheral response would indicate some subjective feeling that they at times would describe. At times the affect seemed incongruous and their description corroborated this feeling, but affect still was present. The reaction times of these patients varied from one second to a refusal to answer. The thinking disorders kept them regularly variable. The quality of the reply varied tremendously. To one word, "comfort," the patient replied "cosy," and to the very next word, "hand," he replied "span."

This patient, a male, aged 46, single, has been in hospital for 26 years deteriorating rapidly in all spheres. A sample of his responses to stimuli words is as follows:

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Stimulus word.	Reaction time.	Reaction production.
Table	25 seconds	Think the most natural thing to think of is a table turning (much flushing of the face).
Dark	8 ,,	Horse (smiles)—the dark horse.
Music	15 ,,	Prize (closed eyes).
Man	3 ,,	Kind (rubbed hands, stolid face).
Deep	4 ,,	And that is where the two conflicting things come in—food—deep apple pie—Mr. Warwick Deeping—how deep (smiled and seemed amazed).
Soft	180 ,,	Dead (chuckled, rubbed hands)—the most valuable asset and aid is to have a friend who can discuss one's symptoms).
Butterfly	20 ,,	Putting the word the other way as flutterby (restless, flushed, looked sheepish).
Woman	420 ,,	Enigma (amused, chuckled, blotched and flushed, restless).
Love	20 ,,	Be at home (face and neck blotched, restless, sighed).
Kiss	45 ,,	And of course there is where an oath comes in—kiss the book (restless, sighed, flushed).

This list of reaction productions shows intellectual dilapidation, but at times glimmering through is a show of affective feeling and some intellectual acuteness. The affect is not always harmonious, but there can be no doubt that affect is still present, although utilized wrongly.

Discussion.

The above case-records have been presented primarily to bring to the fore the fact that in many patients with the schizophrenic reaction, the affective response can be and often is surprisingly active, adequate, labile, appropriate and deep. This seems to be the case more often in those patients who have not been ill for very long periods, but affect still seems to be preserved in certain patients who have regressed to more primitive levels of adjustment. Patients who have developed a well systematized delusional trend may retain their affect unblemished for countless years. In the past few decades that have elapsed since Kraepelin formulated his dementia praecox category, psychiatric thought has altered in many respects. The metamorphosis of the affect problem is no exception. We have quoted at the outset the views of Kraepelin, but since his original promulgation many similar views have been propounded. Textbooks of psychiatry have usually represented the prevailing opinion of their period. Paton, for instance, in his book, *Psychiatry* (1905), mentioned that as the morbid process advanced, the patients with dementia praecox became more and more blunted emotionally and indifferent to their surroundings. He felt this to be characteristic of emotional state. Diefendorf (1912), in his English version of Kraepelin's *Lehrbuch der Psychiatrie*, states: "The disturbance of the emotional field is another of the characteristic and fundamental symptoms. There is a progressive, more or less high-grade deterioration of the emotional life. The lack of interests in the surroundings may be regarded as one phase of the emotional deterioration. Early in the disease, and especially during an acute and subacute development, the emotional attitudes may be one of depression and anxiety. This may later give way to moderate elation and happiness. The latter, however, in a few instances prevails from the onset. Yet emotional deterioration remains a fundamental symptom." In 1913 Dercum, in his book, *A Clinical Manual of Mental Diseases*, mentioned the early depression, apathy, lack of spontaneity, with the interspersion often of noisy and disturbed periods. Stupor may occur in his opinion following profound depression. In general he subscribed to the cycle of initial depression, subsequent expansion, and ultimate mental failure. Stoddart (1919) expressed essentially the same opinions. A very different and contrasting slant was taken by Harry Stack Sullivan in 1925 as mentioned above. In support of his view that these patients had a very active subjective emotional life despite the outward appearances he quoted Tuke, who declared that from his personal impressions many patients who appeared to be indifferent to flies walking on the face, described their delusions with the attendant unpleasant affective aspect which they were experiencing at those

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particular moments. He felt that many times the alienist could not decide whether the outward expression mirrored exactly the mind, and whether the mind was actually a complete blank, "or the seat of intense depression or painful delusion." He felt that there was a change in the conative set of these "apathetic" schizophrenics, and that it was accompanied by an *increased blankness* of countenance. "It seems to do violence to common sense to assume in the face of these observations that there is no affective experience present. That schizophrenic cases, at least early in their illness, do actually have affective experience has not escaped the psychiatrists of the Kraepelinian period." Lang (1939) supports these ideas from his own personal experiences. Sullivan remarked about one of his schizophrenic patients as follows: "This patient during his 23 months under my observation has expressed by facial postures, by intonations, gross behaviour, and by word of mouth, wellnigh the gamut of human emotions. They have seemed to bear a simple relation to the content of awareness, or else they were clearly evidenced as verging upon awareness." In his clinical experience, Sullivan felt that much evidence has pointed to the survival of affective life in schizophrenic patients. None of this evidence has seemed to require a conception such as that of "emotional disharmony." He reiterated in conclusion that "both from crude observations and from detailed study of the facial expression, the alleged indifference, apathy and emotional disharmony of the schizophrenic patient are more a matter of impressions than a correct evaluation of the inner experience of the patient." These remarks reveal a right-about face in regard to the usual textbook picture of the affectivity in schizophrenia.

The authors of textbooks in the last fifteen years have not notably altered their fundamental opinion of the affective state, which has paralleled Kraepelin's view. Bleuler felt that under no conditions did affectivity disappear, but that by touching on the complexes it could be provoked even in apparently indifferent patients. He felt that when an organic disease complicated the schizophrenic picture the entire affectivity may reappear, which implied that it was still present, but prevented from appearing. A plain fundamental mood of euphoria, depression or fear existed usually according to Bleuler. Noyes believed that the presence or absence of tension was of prognostic value, that when present it signified that intrapersonal conflict was still seething and that reality had not been forsaken. Kasanin in 1933 described the schizo-affective psychosis. This syndrome is now well known to us and no summary of it is necessary now, but the main point we are interested in is that the patients with this process show an abundance of affect both during and after the psychosis. Henderson and Gillespie (1940) remark that although apathy and indifference seem to be prominent, they incline to agree with Sullivan that more affect is present than would seem on the surface. Sadler (1936) felt there was real emotional apathy, and that even in the most appealing emotional situations these patients seemed cold and indifferent. This view corresponds in general with that of Strecker and Ebaugh. Cameron (1938) felt that the dulling of the emotions might be a part of the withdrawal syndrome.

The state of the affects has figured in the evaluation of results of the treatment of schizophrenic patients with insulin, cardiazol and triazol. Langfeldt (1937; quoted by Schaeffer, 1938) felt that the atypical schizophrenic patient who received the various shock therapies had the best prognosis because that patient usually showed more affect and had no emotional deterioration in the Kraepelinian sense. He believed that it was "the doubtful cases" which did best, those cases which on admission suggest schizophrenia, but later are found to be composed of mixed manic-depressive or reactive (paranoid, hysterical, asthenic, cyclothymic, schizoid, etc.) states, based on psychopathic constitution, or exogenous (symptomatic), traumatic and psychogenic psychoses. We rather incline to these views. He points out also that spontaneous remissions are more frequent in the acute atypical cases than in the typical schizophreniform cases. Stalker (1939) concluded similarly, and stated that of a number of features which had a favourable prognostic import, "a well retained affective response in the illness, with absence of disharmony between the affect and the thought-content," was most important. Langfeldt decided that shock therapy shortens the duration of those conditions, which would have recovered anyway. Many of our patients who were given cardiazol or triazol exhibited tremendous affective responses in the interval between the injection of the drug and the actual convulsive turmoil. Fear and apprehension were predominant.

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Even patients not included in this picked series of cases exhibited the same fear, anger, anxiety after the first few injections. Schizophrenic patients receiving insulin reacted similarly, manifesting an intense mobilization of affective energy and refuting the time-worn expression of "emotional blunting." The shock therapies of to-day seem to be mobilizing the affective drives of our patients even as some of the older types of therapies in the last century, such as swinging of patients from ropes, ducking them in water, etc. Now electric shocks are being used to treat a condition which we remain ignorant about relative to the cause, even as the ancients treated medical and psychiatric patients with electric eels and catfishes for the shock benefits, and Franklin treated many diverse medical conditions with the static spark. These methods, however, must not lead us to forget the detailed study of our patients. Their assets, intellectual, affective, moral, etc., must still be measured and a complete personality inventory made so that the results from treatment may be standardized along some tangible lines instead of along temporal lines. The affect is better preserved in those patients who have been ill only a short time, but also the affects are better preserved in the paranoid cases of long duration. Stalker (1939) also reported that the percentage of spontaneous remissions equalled that of those who had received insulin, cardiazol or triazol, and that those recovering following these shock therapies were those patients with good retention of their affects. This merits closer scrutiny for those workers in this field, as it signifies that a more minute investigation of our patients' personalities is essential to determine their potential recoverable rate.

The most outstanding feature of the above case-records was the frequency of the sexual conflict, mostly about masturbation. Most of the patients were young; they usually possessed personalities which did not augur healthy, successful attacks upon the problems of daily existence; they tended to introspect, to be sensitive, and they usually reacted to some environmental stress. Many of them had had previous attacks with clearing, but had broken down again. The onset usually was sudden. In some of our early patients, and in many of our chronic patients, there was some intellectual or cognitive and conative deterioration, with a good preservation of the affective sphere. It would seem safe to conclude that those patients whose affect remained strong itself and in harmony with cognition and conation have a better chance for a remission. A Rorschach test might add to our ability to prognosticate recoveries. The shock therapies seem to reintegrate the affect into the cognitive and the conative spheres by stimulating primarily the affects.

Conclusions.

1. The affect may be well preserved in certain mental diseases that have the schizophrenic stamp. This retention is contradictory to the usually accepted opinion that there is blunting, apathy, indifference, incongruity and disharmony in every schizophrenic patient.

2. The word-association test is a simple satisfactory bedside method for the indication of the state of the affects in these patients.

3. Those patients with good preservation of their affects are the most suitable candidates for shock therapies. Patients who have benefited from these therapies have been labelled atypical schizophrenics because they have exhibited certain manic-depressive and/or reactive features in the nature of affective disturbances.

4. The affect in the younger schizophrenic patient is many times more labile, appropriate, adequate, deep and active. In the more chronic patients it can still be aroused, but is more liable to be incongruous, inappropriate, rigid, and ephemeral.

5. More minute personality inventories should be forthcoming to aid us in evaluating what personality factors are operating for or against recovery.

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TORULOSIS OF THE CENTRAL NERVOUS SYSTEM.

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IN March, 1939. there was admitted under my care at the St. Pancras Hospital Mental Observation Unit a case of torulosis of the nervous system. This is a very rare disease in this country and the present case is only the third recorded in British medical history (Greenfield *et al.*, 1938; Smith and Crawford, 1930), and the first one to have come under mental hospital supervision. Although such a rarity here, torulosis is more common in the United States, and cases have been reported from nearly every part of the world.

A thorough search into the literature on this subject led me to believe that cases may sometimes be missed through ignorance of the clinical and pathological features of this infection. This paper is written with the object of presenting a picture of the outstanding characteristics of torulosis of the nervous system in the hope that if these are more generally appreciated, cases will be diagnosed which might otherwise have been missed.

HISTORY AND NOMENCLATURE.

Fungus diseases of the nervous system have been described since the early days of bacteriology and pathology. Originally, however, pathologists attributed to fungi many infections really due to cocci; consequently fungus infections fell into such disrepute as to be considered almost non-existent. It is quite likely that cases of fungus infection are more frequent than we think.

The first indisputable case of infection of the human central nervous system by a higher fungus was demonstrated by Zenker in 1861. Since then sporadic and infrequent cases of invasion of the nervous system by several different forms of fungus have been described. In 1916 Stoddard and Cutler first differentiated the characteristics of torulosis, which was subsequently found to be the commonest form of fungoid infection of the central nervous system.

Various names have been appended to the organism producing this disease. Stoddard and Cutler correctly realized that it was related to examples of torula occurring elsewhere in nature (Fotheringham, 1902; Henrici, 1930), and christened it *Torula histolytica*. Greenfield (1924), on the other hand, refers to it as *Cryptococcus hominis*, and such synonyms as *Torulopsis hominis* and *Saccharomyces tumefaciens* have also been used. I propose in this article to retain the original name "Torula," but since Freeman (1931) has shown that "histolytica" describes the characteristic of the organism erroneously, we shall refrain from the use of doubtful adjectives.

GENERAL PATHOLOGY.

The organism is a pseudo-yeast, several species of which have been known for many years to infect animals. Although it is said frequently to inhabit the human nasopharynx (Jones, E. L., 1920), and intestinal canal (Anderson, 1917) saprophytically, it is fortunately seldom pathogenic to man. It is, broadly speaking, differentiated from other infectious fungi by the absence of mycelation and sporulation, the process of budding as a means of reproduction and its poor fermentative powers.

Torula may infect the central nervous system (*a*) specifically and alone, (*b*) in combination with systemic lesions elsewhere, (*c*) combined with pulmonary lesions

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only. Reporting on the 60 cases of torulosis described in the literature up to that date, Levin (1937) found that 30 (50 per cent.) cases had been confined to the central nervous system alone, 9 (15 per cent.) of the others were associated with lesions of the lungs only, and 8 (13 per cent.) with a generalized systemic infection. Other organs involved in association with the central nervous system were: Kidney (2), spleen (1), adrenal glands (1), abdominal lymph glands (1), peribronchial lymph glands (1), tonsils (1), subcutaneous tissue (1) and skin (5). Others have described involvement of the thyroid, bone marrow and prostate.

The occurrence of skin lesions in this series is interesting, since other authors (Freeman, 1931; Stoddard and Cutler, 1916) have claimed non-involvement of the skin as a primary lesion to be one of the differentiating distinctions of torula infection from other fungus infections. Mitchell (1936) has drawn attention to the association of torula infection and Hodgkin's disease in certain patients, even going as far as to point out the similarity of the clinical appearance and histological reaction in the two diseases. In certain cases, tuberculosis of the lungs has co-existed with a torula infection of these organs (Freeman, 1931).

The organisms vary very considerably in their size from one case to another. At one end there are minute rounded bodies scarcely one micron in diameter, and at the other large bodies 40 to 50 microns across. Their shape under the microscope is round or oval. They all have a capsule, but here again their characteristics differ. Some have a well-marked capsule which may be as thick as twice the diameter of the body itself, so that the organism has the appearance of being surrounded by a halo of clear space. At the other extreme it is only with a very careful search under the high-power microscope that any capsule at all is found. Any intermediate grade may occur.

Staining Reactions.

Haematoxylin and eosin usually stains the organisms a bright blue, but sometimes pink, and not infrequently fails to stain them at all.

The aniline dyes (thionin and methylene blue) stain most of these organisms darkly, but some of them remain unstained.

Gram's stain.—The organism reacts in an amphophilic manner, many organisms staining darkly, but others becoming pink. The capsule stains in a characteristic manner which reveals multiple radiations traversing it.

Cultivation.

The organisms will grow on almost any medium at room temperature of 37° C., but thrive best on blood-agar, Loeffler's medium and Sabouraud's medium (maltose agar). In all three they grow at the bottom of the tube and do not turn it turbid. The appearance of the colonies may be likened to elevated and piled-up droplets of boiled starch.

Animal Inoculation.

Transference of the infection to animals is frequently the only reliable way to effect a diagnosis. The most susceptible animals are mice and rats. In guinea-pigs the localization of the infection specifically to the brain and testicle is practically pathognomonic. Rabbits are comparatively resistant and usually infection has no effect on them at all. An important practical point is that the organism in a few instances takes as long as six months to cause illness in its victim, so that diagnosis must not be considered negative in infected animals until at least that period has elapsed without symptoms. The animals must be injected intra-peritoneally or intra-cerebrally. Intranasal application does not affect the central nervous system if the nasal mucous membrane is uninjured or free from disease.

Post-mortem Appearances.

(a) *Macroscopical.*

The Central Nervous System.

The infection is almost invariably confined to the leptomeninges and the brain and spinal cord. It has been known to involve the Gasserian ganglion, however, and even to perforate the dura mater and involve the skull.

The degree to which the meninges are involved varies. Sometimes nothing is noted beyond a few nodules of approximately 1 to 3 mm. diameter scattered over the following positions singly, or in any possible combination: (*a*) the cerebral cortex, (*b*) the Sylvian fissure, (*c*) the junction of fissures about the optic chiasma. In others basal meningitis is the outstanding feature, while universal thickening of

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the meninges over the convexity of the brain may occur in others still. The resemblance to miliary tuberculosis or tuberculous meningitis is often quite marked.

The meningeal and superficial cerebral vessels are frequently markedly engorged, but thickening of the pia and arachnoid themselves often obscures this to a large extent.

The cerebral meninges are the most commonly involved, but the cerebellar and spinal ones are also frequently affected. Greenfield (1938) has shown how certain cases have been diagnosed antemortem by removal of a portion of cerebellar meninges for biopsy. These cases were, previously to operation, diagnosed as cerebral tumour of the posterior fossa, but on exposure nothing beyond a suspicious-looking cerebellar meningitis was found.

The subarachnoid and intraventricular spaces are frequently filled with a gelatinous, starchy fluid, usually turbid in appearance and grey in coloration, but sometimes translucent and of a yellow coloration.

The brain itself usually shows a varying number of cysts of the grey matter. Sometimes the whole of the cortex is riddled with small cysts, giving it the so-called "soap-sud" appearance; sometimes they are less numerous and more discrete, and very occasionally only a single large cyst occurs. Minute cysts may also be seen in the basal ganglia, and occasionally in the cerebellar cortex and spinal cord. The cysts are filled with a gelatinous starchy fluid similar to that in the subarachnoid spaces. No caseation or abscess formation takes place.

White, rather hard, trabeculated bodies of varying numbers and sizes (up to 2 cm. diameter) can sometimes be seen in the grey and white matter of the cerebrum and cerebellum. These are due to conglomerations of the granulomatous material.

The Lungs.

The lungs may be permeated with granulomatous masses varying in number and size. These may take the form of minute yellow or brownish tubercles (called by Hirsch and Coleman (1929) "acute torulosis") and looking to all intents and purposes like the condition seen in miliary tuberculosis; they may have more extensive limits and appear rather like patches of tubercular broncho-pneumonia; or they may be very large and occupy the greater part of a whole lobe. When of a large size, these masses have a soft, necrotic centre composed of a characteristic pinkish gelatinous material which when evacuated leaves a rugged cavity. There is seldom any visible caseation and never any gangrene or putrefaction.

Other Organs.

Similar types of lesion occur in other organs. On the one hand one may have numerous embolic tubercles, or on the other, large granulomatous masses whose centres tend to soften and necrose. Caseation and true abscess formation are unknown, unless secondary infection takes place.

(b) *Microscopical.*

The histo-pathology of this disease reveals in all cases a specific type of granulomatous lesion. This consists of the following formation: At the centre of the lesion, endothelial cells and fibroblasts react by marked proliferation. More peripherally some small round cells and plasma cells may be present. Polymorphs of all types are conspicuous by their almost total absence from the lesion. Giant cells with centrally placed nuclei occur towards the innermost parts of the lesion. These are usually of a foreign body type, but occasionally of a tuberculous one. Scattered throughout the lesion are rounded, poorly staining, hyaline bodies, usually extracellular, but sometimes intracellular, which are recognized under the microscope as the organisms themselves.

The Central Nervous System.

The microscopic pictures are of a typical nature, but resemble syphilis in that they are sometimes of an intense, localized, granulomatous nature resembling a gumma, and at others of a more diffuse and less granulomatous nature. The more diffuse the meningitis, the less the proportionate number of giant cells and the greater the number of endothelial ones.

The picture seen in the cerebral substance explains the already described

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macroscopical characteristics seen there. The so-called diffuse cysts are found to be due to direct invasion of the brain substance by the organisms themselves, and this usually takes place along the perivascular spaces, producing bottle-neck cystic enlargements. The deeper cysts (so-called) are found to be due to masses of the organism also. The nerve cells around the cysts are deformed and misshapen, due to pressure on them of the manifold organisms, but they exhibit very little abnormality of Nissl granules or general structure when stained appropriately. Moreover, very little of the lipoid substance characteristic of nerve degeneration is ever found. This shows that the destructive action of the organisms is attained by pressure and not directly by histolysis. Neuroglia exhibits very little proliferative reaction in these lesions. Granulomatous masses (as opposed to cysts) may be seen in the cortex, the basal ganglia and white matter of the brain. They form white, rather hard, trabeculated bodies which may reach a diameter of 2 cm. or more.

The Lungs.

In the lesions here, more fibrosis and inflammatory reaction is discernible than in those of the brain. The organisms are nearly always recognizable if sufficient care is taken.

Other Organs.

Similar granulomatous reactions (to those in the lungs) may occur.

The Cerebro-spinal Fluid.

1. Changes in the cerebro-spinal fluid are almost invariably present, but like other signs of this disease, their degree of variation from one base to another is considerable, and if the disease is not to be missed, one must be fully acquainted with the picture as a whole.

1. *Pressure.*—This is usually raised, commonly to around 300 mm. of water and occasionally higher, having reached in one case to 700 mm. of water. It has been stated that sometimes the pressure is not raised, but Freeman (1931) says that if a manometer is used, failure to register an increase would be found to be an outside rarity.

2. *Specific gravity* is usually about 1008.

3. *Colour consistency*, clear, xanthochromic, or turbid ; often throws down a heavy sediment. In many cases a pellicle forms on standing.

4. *The cell count* varies within the extreme limits of 3 and 1,000 cells per c.c., usually between 300 and 700 cells. These are for the greater part lymphocytes, but occasionally polymorphs reach as high as 30 per cent. Red blood cells may be present. If a very high cell count is recorded it must be regarded with suspicion, since it is probable that many of the so-called cells are really unidentified torulae.

5. *The albumen and globulin* content is usually increased.

6. *The sugar content* varies, but is sometimes considerably decreased.

7. *The colloidal gold curve* is sometimes of a luetic and occasionally of a paretic type.

8. *The Wassermann reaction* is negative.

9. *The torulae organisms* are nearly always present and may be cultured from the fluid.

Examination of the Cerebro-spinal Fluid.

Several points of importance are to be noted. (1) In order to exclude the presence of the organisms, the pathologist should never fail to examine the cell deposit under the higher powers. (2) Smears made from centrifugal deposits are liable to destroy these fungi in the process.

Therefore a hanging drop preparation of this sediment on examination in an official " blood count " chamber are the most likely means of detecting the organisms. A useful help is to mix a drop of Indian ink with a loopful of the sediment on a slide, place a cover slip over it, and examine under the microscope. The organisms will be surrounded by a " halo " owing to the failure of the ink to stain the capsules.

Finally, it has to be remembered that microscopic examination is frequently inconclusive, and cultivation and animal inoculation are essential for a definite diagnosis.

Aetiology.

Very little is known of the aetiology of the disease. The organisms are widely spread in nature and have been found in plants, insects, butter and milk. Fortunately they are very seldom pathogenic to man, although they are claimed to have been isolated in saphrophytic forms from the human skin, throat and gastro-intestinal tract. When this is so, the way in which the organism gains access to the body is not understood. Most authorities agree with Freeman that it is seldom

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a primary infection of the skin. The question of entry by the tonsils, nasal mucous membrane, respiratory tract or alimentary tract has not been settled. Freeman and Weidman (Freeman, 1931) produced a meningeal invasion by use of intranasal swabs. In all cases a requisite amount of trauma was necessary.

The disease, as far as is known, is mainly one of adult life. Up to date its incidence has been higher in the male than in the female sex. It is more common in the U.S.A. than elsewhere, but its distribution is universal and it may attack persons of any occupation or race.

Symptomatology.

From what has been said of the varying pathological manifestations of these organisms, it is not surprising that they produce symptoms which can mimic several different diseases of the central nervous system.

Levin (1937), summarizing the reports on the 60 cases reported up to that time, found that their diagnosis prior to the results of culture of the cerebro-spinal fluid or autopsy were as follows:

Tuberculous meningitis	10
Meningitis, unqualified	5
Encephalitis	7
Tumour of the brain	6
Abscess of the brain	4
Dementia psychosis	5
Dementia paralytica	2
Miscellaneous	2
Unstated	19

We see from this that although the majority of cases tend to present themselves primarily to the neurologist, a certain number will come for diagnosis to the psychiatrist. Moreover, some of the former group may, as in the present case, terminate in a mental hospital ward.

Certain clinical tendencies in this disease are worthy of special note. The disease tends to take a chronic, but almost invariably fatal course (only one case up to date is reported to have recovered). More often than not, it commences with headache. This gradually becomes more persistent and more severe and is usually localized in the frontal region. It is followed sooner or later by the onset of other symptoms, usually of a meningo-encephalitic nature, e.g. faintness, vertigo and vomiting, etc. Stiffness and rigidity and pain of the neck are frequent, and are often associated with positive Kernig's and Brudzinski's signs. Staggering gait, ataxia and hemiplegia have been noted. Paralysis of the higher cranial nerves may give rise to such symptoms as amblyopia, diplopia, strabismus, nystagmus and ptosis, and extensive basal meningitis may produce all forms and degrees of irritation and paralysis of the lower cranial nerves.

Sometimes organic disease of the brain may be simulated, and this occurs especially in older persons. In this respect it is worth quoting Meyer's case recorded by Freeman (1931):

> "The patient was a white female, aged 59 years, who lived in Easton, Maryland. She came of a family in which there were several psychoses, and, herself, had always betrayed anxiety. For many years also she had suffered from haemorrhoids. In March, 1925, she became more than usually querulous, complaining, suspicious, and in August complained of marked weakness and distress upon any exertion. The onset of the real illness, however, was in September, with headache and pains in the limbs, which condition was associated with great apprehension, agitation and depression. She complained constantly, and was very fearful. To this was later added confusion, and she was admitted to Phipps Clinic on December 12, 1925, with a diagnosis of agitated depression. Examination showed considerable emaciation. The temperature rose occasionally to 100·4° F., the pulse was 95, the blood pressure 110·70. The pupils were normal, speech was thick, there were tremors of the tongue, eyelids and hands, the patellar reflex was greater on the right than on the left, but the Babinski sign was negative.

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"The blood Wassermann reaction was negative, the haemoglobin 66 per cent., W.B.C. 8,760, N.P.N. 50 mgm. The urine showed a trace of albumin but nothing else. The spinal fluid contained a moderate amount of globulin, with 27 cells; the Wassermann reaction was negative, the colloidal gold curve 123421000, mastic 555554321000.

"The patient became semicomatose shortly after admission, with stiffness of the neck and a positive Kernig sign. Examination of the fundus showed choking of both discs. The tongue became dry. Cheyne-Stokes respiration developed and death resulted on December 27, 1925, after an illness of three months. The final diagnosis was agitated depression with superimposed organic disease of the brain.

"Necropsy showed little except chronic nephritis and thickening of the meninges. The brain in this case was considered normal, and was released for anatomical study until examination of the hypophysis revealed characteristic thickening of the meninges in the neighbourhood, with fibrosis, cellular infiltration, and the presence of large pale rounded bodies with narrow capsules, evidently torulae. Some lay free in the meshes of the meninges, others were enclosed in multinucleated giant cells. This finding led to more detailed examination of the brain, and there was found a patchy thickening of the leptomeninges, especially about the chiasma and floor of the third ventricle, and in places over the convexity. On microscopical section, abundant evidence of torulae was revealed."

The headache may be associated with insomnia, restlessness, irritability, confusion, delusions and hallucinations, or alternatively with somnolence, apathy, amnesia, lethargy and coma.

The disease is usually afebrile and very rarely has a temperature of over 101° F. The blood pressure is normal and there is no abnormality of the urine. The blood count is usually normal, but variations of the leucocyte count of a non-determinant nature have been described. Eosinophilia does not occur.

Enlargement of the lymph glands is frequent, and may lead to erroneous diagnosis of tuberculosis or even Hodgkin's disease. Signs of involvement of the lungs may mislead one to a diagnosis of tuberculosis of the lungs and meninges.

Differential Diagnosis.

From the above discussion on symptomatology, it is obvious that diagnosis must be made from: Meningitis (tuberculous and other forms); encephalitis; tumour of the brain; abscess of the brain; general paralysis of the insane, and the senile psychoses. Clinically, the diagnosis from other fungi and yeast infections may be difficult. A point of importance is said to be the rarity with which the skin is involved in torulosis of the nervous system, especially in the early stages of the disease. Fortunately, pathological details leave little doubt as to the organisms responsible, and make it easy to differentiate torulosis, provided the details are known. It is not proposed here to give a long discussion on the matter, but the following Table I synthesized from the findings of many authors demonstrates the main features and may be useful for reference in doubtful cases.

Treatment.

The biological characteristics of the organism, such as its resistance to temperature, drying, changes in hydrogen ion concentration, roentgen rays, aniline dyes, etc., its thick capsule and the poor reaction it produces in the tissue of its host render it particularly difficult to influence, and up to date no medicinal treatment has proved of any noteworthy effect in stemming the dread and relentless progress it pursues.

The following treatments have been tried with no effect: Massive doses of iodides; mercury preparations; tartar emetic intravenously; intra-spinal injections of iodides, colloidal silver, gentian violet and merchurochrome.

Shapiro and Neal (1925) tried out the effect of various drugs on cultures of this organism—sodium iodide 1/500, quinine sulphate saturated, sodium salicylate 1/500, colloidal silver 1/600 and magnesium sulphate 1/500 had no affect on the organism, but acriflavine 1/10,000 was found to have important inhibiting powers

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TABLE I.—*Showing the Main Pathological Characteristics of Various Fungoid Infections in Man.*

	Saccharomyces.	Monilia.	Torula.	Blastomyces.	Coccidiodesis.
Synonyms	1. True yeast	1. *Oidium albicans*	1. *Torula histolytica* 2. *Cryptococcus hominis*. 3. *Torulopsis hominis*	1. Gilchrist's disease 2. Chicago disease	1. Californian disease. 2. Coccidioidal granuloma.
Size in microns	5 to 15	3 to 30	1 to 50	8 to 20	5 to 75
Mycelium	—	±	—	—	—
Hyphae	—	—	—	—	+
Endospores	?	—	—	—	+
Budding	+	+	+	+	—
"*Halo*" *appearance*	+	—	—	—	—
In culture:					
(*a*) Mycelium	—	+	—	+	+
(*b*) Spores	+	—	—	+	+
(*c*) Colour of colonies	Cream	Cream	Cream, yellow, brown	Grey	Grey to white.
(*d*) Contour of colonies	Round, smooth	Round, smooth	Smooth, moist, muscoid	Radial folds, concentric rings and spines	Fluffy, spiny.
Animal inoculation	None	Rabbits, I.L.*	Mice, rats, guinea-pigs, I.P.* or I.C.*	Mice, rats, I.P.* or I.T.*	Guinea-pigs, I.P.*
Human lesions:					
(*a*) Skin	+	+++	+	++++	+++
(*b*) Systemic	+	++	++	++	+++
(*c*) C.N.S.	+	+	++++	++	++
Characteristic pathological changes	Abscesses, necrosis, polymorphs, giant cells, epithelial growth	Chronic ulceration	Gelatinous tumours, very little inflammatory reaction, marked epithelial hyperplasia, no abscess, no caseation, few polymorphs, giant cells	Miliary abscesses, necrosis, caseation, polymorphs, epithelial cells, hyperplasia	Chronic granuloma, abscess formation, chronic ulceration, giant cells.

* I.C. = intracerebral; I.L. = intrapulmonary; I.P. = intraperitoneal; I.T. = intratesticular.

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on its growth. There are no records, however, of this drug's having been employed therapeutically.

Apart from drugs, repeated lumbar puncture is undoubtedly a beneficial and life-prolonging procedure. It aids in alleviation of the intense headache, reduces the symptoms due to increased intracranial pressure and prolongs life considerably in certain cases.

Case History.

On April 26, 1939, the patient, a male, aged 45, was admitted to St. Pancras Hospital Mental Observation Unit.

He was restless, resistive and difficult to examine, but the following physical signs were made out. He had a mouth containing much sordes, numerous carious teeth, and a dry and heavily furred tongue. His throat was inflamed and parched, and his cervical lymph glands on either side were enlarged. He had cyanosis of the lips and cheeks; some clubbing of the fingers; heart sounds of a very poor quality and an enlargement of the heart to the left. At this stage there were no definite signs of involvement of the respiratory system. A dry scaly desquamation of the hands and feet was noted.

Mentally the patient was in a state of delirious confusion. He was virtually out of touch with reality and inaccessible to any questioning. He was extremely restless, noisy, and over-active, and required constant nursing restraint to keep him in bed. Observation showed him to be hallucinated for all senses. He frequently conversed with visionary personages and sometimes appeared terrified at unpleasant hallucinations. He mumbled and chattered to himself all the time and was so confused that he did not know his relatives when they came to see him.

History prior to admission.—This commenced on February 2, 1939, with the onset of a persistent severe and intractable headache. It was localized particularly across the forehead, and was accompanied a few days later by a pain across the back of the neck and behind the ears, and also an increasing pyrexia and general malaise.

On February 13, 1939, the patient was admitted to the Royal Free Hospital. The physical signs present were similar to those already mentioned as present when I first saw the case, but of a less marked degree. In the central nervous system the only abnormal signs present were some pain on flexion of the head forwards accompanied by a slight rigidity of the posterior neck muscles.

The swinging temperature gradually diminished and after several days disappeared altogether. The headache persisted for a fortnight, but then gradually lessened and eventually ceased altogether. The patient was discharged on March 8, 1939.

Unfortunately the headache returned within a few days and the patient was readmitted to the Royal Free Hospital on March 20, 1939. The following positive nervous symptoms had developed: Kernig's sign and Brudzinski's sign; all tendon jerks excessively brisk; left pupil irregular, but both pupils reacting normally to light and accommodation. At this time nothing abnormal about his mentality had been noticed.

The patient's general condition deteriorated and he lost weight. He was gradually noticed to become restless and overactive and about a month after readmission the earliest psychotic symptoms appeared. He became irrational and deluded and started to refuse his food. His condition became steadily worse, and he was soon so restless, noisy and confused that he was impossible to look after in a general hospital and had to be removed to the mental observation ward.

Subsequent History.

The patient's restlessness continued in the face of large doses of paraldehyde and other sedatives, and he was soon perpetually picking at the bedclothes and himself.

April 29, 1939: Blistering of the internal aspect of both knees was noted. This was the result of self-inflicted friction during restlessness.

April 30, 1939: Despite sedatives, lumbar puncture, etc., the patient continued to become progressively more and more confused and over-active.

May 1, 1939: The patient passed suddenly from delirium to coma and died an hour later.

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Post-mortem Examination.

This revealed the typical picture of a torulosis of the nervous system and elsewhere.

The body was one of a well-built middle-aged man. He had obviously lost weight recently. He had dryness and desquamation of the skin of the feet and legs and large bilateral blood blisters of the knees, due to self-inflicted chafing. Some superficial bruises bore witness to his recent restlessness.

Central Nervous System.

The blood vessels of the meninges and brain were congested and their surroundings injected. The subarachnoid space over the surface of each hemisphere was filled with a diffuse yellow-brown gelatinous material (characteristic of the infection), which was also present to a lesser degree in the ventricles. No cysts were obvious, and slicing up of the whole central nervous system revealed no further macroscopic changes.

The Lungs.

These showed signs of a broncho-pneumonia characteristic of the disease. The lungs appeared normal apart from terminal congestion, and pinkish patches of consolidation with minute yellowish pin-point spots dotted throughout them, reminiscent of miliary tuberculosis.

The only other organic change due to torulosis was the appearance of small pinpoint dots in the kidneys which proved to be embolic colonies of torulae.

The diagnosis of this case, originally made during life by Dr. Joan Taylor of the Royal Free Hospital, who isolated the torulae from the cerebro-spinal fluid, was confirmed by Dr. Margaret Gillespie, of the L.C.C. Laboratories, Hampstead. The post-mortem examination was performed by Dr. Joan Ross of the Royal Free Hospital (the Coroner's pathologist).

In addition to the pathologist named above I am indebted to Dr. Feldman, Medical Superintendent of St. Pancras Hospital, for permission to publish this case; to Dr. Ball, Medical Registrar, for details of the case history while in the Royal Free Hospital; and to Dr. Lilly, Medical Superintendent of Cane Hill Hospital, for his interest and encouragement.

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CONSCIENTIOUS OBJECTORS WITH PSYCHIATRIC STATES.

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CONSCIENTIOUS objection is a problem involving both personalities and society. It has important military, political, ethical, religious and sometimes psychiatric aspects. It is only where conscientious objection arises in a person who shows signs of psychiatric disorder that the psychiatrist has to take an active professional interest. He has sometimes to treat patients struggling with the problem of conscientious objection and sometimes has to report on them to the Recruiting Medical Boards. Thus this aspect of conscientious objection becomes a part of war psychiatry. My own interest in the problem was aroused by seeing a number of psychiatric patients who were objectors.

LITERATURE.

There are few psychiatric writings on conscientious objectors, possibly because the subject is both delicate and difficult. Most of the papers come from continental countries, where the law does not provide for conscientious objection, and where it appears that as a result most of the few objectors that exist are seriously involved mentally. That, of course, is not the case in this country. The Minister of Labour (Bevin, 1942) has said that in this war up to June, 1942, nearly 64,000 men had applied to be registered as objectors. The continental literature, like this paper, cannot possibly be applied to this large group of people. However, I quote later two papers from the United States in the last war, which claim to give a broader interpretation of conscientious objectors as a class.

Schulthess (1934) gave this concise, self-explanatory table of previous writers' cases:

Author.	Motive.	Normal.	Psychopathic.	Psychotic.	Total.
Köppen	Pacifism	1	—	—	1
Ziehen	Seventh Day Adventist	—	1	—	1
E. Meyer	?	—	—	2	2
R. Gaupp	Religion	—	—	1 schizophrenic	
	,,	—	—	1 manic depressive	
	Politics	—	1 paranoid	—	
	Religion	—	1 delusions of grandeur	—	
	,,	—	1 folie à deux	—	
	Religion "in whose case the military offence was due to strong internal conflicts or introspective personalities"	6	—	—	11
S. Loeb	Seventh Day Adventist	—	1 schizoid	—	1
A. Hoppe	Religion	—	1	1	2
O. Marienfeld	Religion (Jehovah's Witness)	—	1	—	1
L. Stanojevic	Religion	—	Diagnosis not known		1
Schulthess's own cases	,,	—	11	5	16
	Politics	—	3	—	3
	Ethics	1	1	1	3
	No specific reason	—	1	8	9
		—	—	—	—
Totals		8	23	19	51

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Schulthess's group of psychopaths apparently consists mainly of seriously involved persons, some of whom would in this country be classified as psychotic. Thus of his own 15 psychopaths, 4 were feeble-minded as well and 6 were schizoid, with suspicion of schizophrenia. Of his own psychotic cases, all were schizophrenic except one general paralytic. Only one person was considered mentally normal, as only those suspected of abnormality were sent for examination. Schulthess thought that where there are obvious pathological conditions it is better that the man be discharged on health grounds than punished as an objector. Lange (1937) wrote on religious scruples as a basis for refusal to serve in the Army and found that conscientious objectors were frequently schizophrenic. Maulin (1938) described a feeble-minded Seventh Day Adventist who refused military duties on Saturdays. Laignel-Lavastine *et al.* (1940) discussed a case of paranoia of Dide's " passionate idealist " type who acted as a conscientious objector and who tried to take measures to stop the war at its outbreak.

May (1920) reported the extensive official experience in the United States in the last war. The Surgeon-General's Office, Division of Psychology, sent to the camp psychologists detailed instructions for the examination of conscientious objectors in the Army. These instructions are given in full in May's paper. They cover mental age ; family, personal, educational, occupational, religious, moral and social histories ; and the grounds and degree of objection. After carefully applying the examination little doubt remained in the examiner's mind as to the objector's sincerity or insincerity. There were, however, no data showing how well the psychologists' recommendations correlated with the findings of the Board of Inquiry. May summarized the reports on about 1,000 objectors, a little less than half the total number in the Army. Objection was not due to inferior intelligence, the objectors being on the average superior to the white draft as a whole. The great majority were " sane." About 50 per cent. were Mennonites (and therefore usually farmers) and most of the rest belonged to small religious sects. 90 per cent. objected on religious grounds ; 5 per cent. on social grounds ; 3 per cent. on political grounds and 2 per cent. on ethical grounds. 90 per cent. were native-born. Speaking generally the average objector was a non-voter, belonged to no social organizations and was not interested in community enterprises. Three main types were distinguished ; the religious-literalist, the religious-idealist and the socialist. Hoag (1920) mentioned that there had been conscientious objectors to many great questions—to religion, political parties, government and medicine. Hoag touched on the history of conscientious objection from the time of the Roman Empire. He said that the objector, although a manifestation of war, was a product of peace ; the causes of his objecting had long been existent in his environment, education and heredity. Each objector must be taken as an individual. He gave interesting and full, although general, descriptions of the main types of objectors according to their religious, political and personality backgrounds. He described the case of an objector, called Stierheim, who in the Great War deserted under fire on conscientious grounds, but performed great deeds of bravery under fire in rescuing wounded men.

Case Reports.

The cases reported were all seen primarily for their psychiatric states and not for their objection. Two patients suffered from schizophrenia, one from a schizoid state and one (Case 4) from a mixed paranoid and manic state which might be related to the schizophrenic types of reaction. There is thus a certain preponderance of schizophrenic types, as found by previous writers.

Hoppe (1919) quoted Jörger's statement that the manic-depressive type is rare among objectors. The later literature confirms this. Only Case 4 in this series showed manic features, but was far from being a typical manic-depressive.

Otherwise the present cases show no specificity in the types of psychiatric reaction developed ; a number of different reaction types appeared. However, their previous personalities fall into three groups of apparent significance in relation to the objection.

(1) *The introverted-asocial group.*—Generally speaking these patients were introspective, shy and sensitive, religious or idealistic, dreamy and unpractical, psychosexually and generally immature, subject to fear, inadequately adapted

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socially and undistinguished in their careers. They do not show *anti*-social behaviour as contrasted with the next group.

CASE 1.—*Obsessive state:* A single man, aged 25, has attended the out-patient department of the Jordanburn Nerve Hospital since March, 1942. He had numerous anxious, ruminative and compulsive symptoms which changed their objects frequently and which had been developing since the age of puberty. His father was medically unfit in the last war from heart trouble, probably functional. His mother is of a very anxious nature. The patient is an only child and was spoiled. From his earliest years he had numerous neurotic symptoms of varying types too numerous and scattered to be easily described. Most were of an anxious kind, including fear of illness. He was shy, sensitive and timid; he was at all times scrupulously honest and truthful. He matriculated, entered an office and took night-classes. In the office he was the odd man out because he did not smoke, swear or drink, because of his religiousness and prudery, and because of the strange disclosures he sometimes made about his symptoms. He was teased about all these things, but in time was able to hold his own. He could be stubborn with people, yet lacked application in many things, such as his music. The patient is a faithful member of the United Free Church of Scotland, and takes part in many church activities. For years before the war he was interested in foreign lands and people, travelled abroad, tried to learn several languages and had foreign correspondents. As a schoolboy he was afraid of fights, and for years said that if a war did come he would be a conscientious objector. He has a gross emotional dependence on his mother, has formed three curious attachments to middle-aged women and has never been able to form a relationship with a girl of his own age. From puberty he had conflict and guilt over masturbation, with compulsive handwashing and fears of harming and impregnating women by casual contact. He had anxious fantasies of sexual misdeeds and once or twice of murdering a boy. The Local Tribunal for Conscientious Objectors registered him for agricultural work. At one stage he volunteered for the National Fire Service to "save life," but had to be released because of his neurotic behaviour. Psychotherapy on analytic lines is being given and the patient is very much better; he only had a few weeks' unfitness for work.

CASE 2.—*Schizophrenia:* A man, aged 21, admitted to Jordanburn in January, 1942, was transferred to West House Mental Hospital, where he remains.

The father had many anxious symptoms as a young man and was therefore rejected medically in the last war. Several other relations had minor psychiatric symptoms. The patient has been subject to enuresis all his life and was very sensitive about this, especially when it occurred in Scout camps or in school by day. He was similarly sensitive about a squint and wearing glasses. As a child he would wander away by himself for the greater part of the day; from age 16 he went alone on hiking holidays. The patient was always "shut-in," shy, good-tempered and obedient, unsociable, unconfiding and rather stubborn. He was very simple, believing all he was told, and was very honest and truthful. As a child he had occasional nightmares, some mannerisms and hypnagogic hallucinations once. His school work was undistinguished except in art. His headmaster and his scoutmaster spoke well of him. He failed the examination for the Civil Service grade his father is in. The employer to whom he was apprenticed as a commercial artist found him hard-working and reliable, but lacking in initiative and originality.

About the beginning of the war, while feeling depressed, he had a religious experience through meeting an evangelist. His parents did not approve of his conscientious objection, which they attributed to his reading books, such as Tolstoy's *War and Peace*, and to the influence of disgruntled ex-servicemen in his place of work and of other objectors among the art students. They advised him to get a medical certificate about his bed-wetting, but he refused. The patient told the Local Tribunal he would accept non-combatant service and went to the Pioneer Corps in October, 1940. (The mother is normally religious; the father is an atheist.) He volunteered for fire-fighting and demolition work in a blitzed city, and after a few weeks there suddenly developed a stupor and was admitted to a military mental hospital. There he improved with cardiazol therapy, but relapsed after discharge. He now has a severe catatonic state with stupor, excitement, many mannerisms, deteriorated habits such as striking others, and visual and auditory hallucinations. He especially thinks that he can communicate with one of his officers by telepathy. Electric convulsion therapy has not helped.

CASE 3.—*Schizophrenia:* A man, aged 23, was in Jordanburn from August to December, 1939, and from October to December, 1940. His father is a chronic alcoholic, whose condition was said to have been aggravated by service in the last war and who abandoned the patient when he was 9 months old. He is still alive, but has never seen his son since; does practically no work and is frequently in hospital. An uncle was an alcoholic. The mother became depressed soon after the patient's birth and was taken to a mental hospital, where she died two years later.

The patient was adopted by a childless uncle and his wife. At 7 he was afraid of traffic and other things. He lacked confidence at games and indeed at most activities. He was shy, reserved and timid; allowed himself to be led by other children; took criticism badly and always felt deeply about his own mistakes, and was a model child of the "home boy" type. At school he only succeeded by great effort. He failed the matriculation the first time, but gained it with a University Scholarship the next year.

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Brought up to believe that his foster-parents were his real parents he began to suffer some doubts about this and was told the truth in January, 1937. He was then studying hard, and in March became mildly depressed, with feelings of unreality. These symptoms recurred at intervals, and the international crisis in September, 1938, brought his sense of reality back for a time.

Like some other sensitive and intelligent young people he had a difficult adolescence, with much speculation upon abstract, philosophical and sexual subjects. He had much conflict about his own personality-worth, including his conscience, apparently before he was an objector. This evolved until in 1939 he was suffering from loss of feeling, also described by him as ennui and accidie. The speculation had evolved into prolonged self-analyses, such as this: "I had the feeling as though I were coming out of something. Simultaneously my beliefs were in a state of change; I was, in fact, rather volatile, with no great religious impulse latterly. In short I was getting to that stage in a young man's life when he begins at last to make something of the world he has never made before . . . My life began to weigh on me as a sort of travesty. . . . The unreality or lack of feeling is quite indescribable, a feeling that the only thing worth having is feeling. To feel sorrow and pain is beautiful, for it is an assurance of life." Clinically, however, the affect was more like anxiety. With the fixity of a delusion he believed that his illness was due to syphilis which was due to masturbation. He contemplated suicide. He received much psychotherapy and two triazol convulsions. Sent home in a remission he registered as an objector. The Local Tribunal registered him for non-combatant service, which he was willing to do, but the Recruiting Medical Board rejected him entirely.

Readmitted in a relapse, he no longer attended properly to his personal needs and had grosser abnormalities of the thought content, including delusions of being influenced and of influencing others. About the wireless he said: "My conscientious objection affected my response to the news; I seemed to have a double feeling and able to read the feeling of the announcer." Afraid of more convulsion therapy he returned home and later went voluntarily to a mental hospital. After treatment he was discharged. In September, 1942, his uncle wrote that he was very much improved and had been working in a library since August, 1941.

Case 4.—*Mixed paranoid and manic states:* A single man, aged 37, was admitted to Craig House Mental Hospital in May, 1941. He had an elated but unstable mood, pressure of speech and psychomotor activity; the thought content was grandiose. The illness developed as an atypical manic or exalted paranoid reaction.

His father was a very religious man and held several church offices; he served in the Volunteers in peace time, but was too old to serve in the last war. The mother had a very anxious temperament. The patient was devoted to both parents. In the last war the family suffered from financial stress due to war conditions.

The patient was always shy and diffident about speaking. As a child he had nightmares, sleepwalking, bedwetting and fear of heights. He was frequently off school with indefinite illnesses, including two separate years' absence. He left at 19 without his matriculation, trained as an engineer, qualified during the economic depression of 1929 and could only find a few odd jobs. So he opened a small radio shop, which afforded a scanty living. He was psychosexually immature; he formed slight attachments to two girls when he was 25, but felt curiously tormented in his feelings then and felt better after he ceased to interest himself in girls. Now he forms attachments to boys in their teens. He was very religious; he always lived at home.

At the outbreak of war he expressed strong pacifist views and stopped going to church because the church had failed to stop the war. He suffered much conflict about his views: "I have no notion for killing . . . . you can't say that all the good men are on one side and all the bad on the other. I had thought a lot about it and had almost made up my mind to register as a conscientious objector, but that name just stuck in my throat. Most folk look on an objector as a dodger rather than a man with true religious beliefs, so in the end I just drifted in and registered in the ordinary way." The period of conflict led to a solution in his symptoms: "God showed me the way to get the war over. It is His plan and I am His instrument; even my thoughts are His. Then there will be peace and plenty for everyone." He gave away his money as everyone was to be equal; was convinced he had powers of healing, and brought home for treatment a boy crippled by anterior poliomyelitis. His conduct became grossly disordered and he was certified. Discharged on probation in August, 1942, he was seen in September. He still regarded himself as an exceptional person, was writing a book and received spiritualistic messages, sometimes by a voice, more often by "passive thoughts."

(2) *Antisocial group.*—There is only one such case. His record shows that he has always been antisocial, in not only one but several aspects of his behaviour.

Case 5.—*Psychopathic state:* In September, 1940, the police surgeon referred a man, aged 24, who had twice been guilty of sexual offences. The paternal grandmother is a religious eccentric; both she and a paternal uncle cause much family friction. The father was in a reserved occupation in the last war; he is "against war"; he suffers from slight bouts of depression. The patient was always quiet and shy on the surface and liked his own way. He was always faddy about his clothes and as a child he more than once refused to go out because he did not think

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his clothes were right. For long he suffered from nail-biting and fear of heights. At 13 he had sexual intercourse on three occasions. From 18 he associated with many women, only to secure sexual gratification. He was frequently intoxicated. When his mother protested about his drinking companions he quarrelled with her and went into lodgings in 1939. He found that drink made him happy and increased his sexual desires; it enabled him to pick up women in a way he could not when sober. His two offences, known to the police, of accosting women and of indecent exposure occurred after drinking. The first was before the war began and the second was after. He was fined each time.

Before the war he had no special interest in religion, politics or community organizations. When war was declared he said he was not going to go although he thought he would be shot for this. Then he found he could register as a conscientious objector. Both the Local and Appellate Tribunals removed him without qualification from the register of conscientious objectors. His reasons for objecting were commonplace rationalizations: "I do not hate the Germans. War is against the principle of the brotherhood of man." He ignored repeated notices to appear at Medical Boards, and so was summoned to Court, where he was fined, with the option of 20 days' imprisonment. To show his continued resistance the patient refused to pay the fine and went to prison. He refused to let the prison medical officer examine him until he was assured that such examination had no connection with recruiting.

He attended as an out-patient and continued at work. He did not have any intercurrent psychiatric reaction and his condition is a psychopathic state, as described by Henderson (1939). He has stopped drinking and has married. He now claims to give much thought to religious, political and philosophical matters, and to be writing a book; he is very proud of his "ideas," which are really trite or childish. For example: "I think it would be a better world if we learned to make ourselves accountable to God instead of our next door neighbour. One fellow said to me that he didn't like the tie I had on; he must have been under the delusion that I put it on for his benefit. I think I am quite capable of buying my own ties, and if people outside don't like it they're not forced to look, are they?"

He refused a psychiatric report for the Medical Board, saying that if by any chance he were passed fit he would not go to the Forces. I felt he was simply maintaining a consistent resistance. However, after a second prison sentence, he accepted a report in June, 1942, and the Board found him unfit for service for psychiatric reasons.

(3) *Mixed group.*—In this group each case shows a remarkable mixture of both the introverted-asocial and the antisocial features of the first two groups.

CASE 6.—*Hysteria:* A man, aged 31, was admitted to Jordanburn in September, 1940, with an hysterical spasmodic torticollis. His father served throughout the last war; as a child the patient heard his father speaking in his sleep of his war experiences. The father gambled, drank and caused much unhappiness at home; the patient did not, however, associate the last symptoms with his father's war service. As a child the patient had nightmares and fears of the dark. The parents and eight children lived in one room in a condemned house. He was dour and rebellious at school and at home; ran away from home more than once and received many thrashings for disobedience and stealing at home. He also stole outside and appeared in Court for this four times before the age of 17 and was once birched. From 14 he worked in iron foundries and from then onwards he frequently had symptoms such as dizziness, fatigue and fears of people, his work, diving, darkness, fire and vermin; he had various bodily symptoms and at 15 consulted his doctor for functional heart symptoms. He boxed a great deal and fought about 70 contests for money, yet at the same time was afraid of boxing. All the money he could get was spent on gambling on dogs, horses and cards; he often sat up gambling until the early hours and was not able to work properly next day. There was some pre-marital intercourse. At about age 20 he twice tried to join the Regular Army, but was rejected—apparently for the state of his teeth at the time.

At 23 he was suddenly converted to the Plymouth Brethren. No mental preparation preceded the conversion, but it was certainly sincere. His disordered conduct ceased and his phobias diminished. He spoke at open-air meetings, generally paraded his religion, and really gloried in being as notorious for his conversion as he was for his previous conduct: "Hundreds of people knew me through my boxing . . . ask anyone in A—— and he will tell you what a marvellous change has taken place in my life."

He based his objection in a stereotyped manner on Biblical passages. The torticollis developed at the time of registration, when he was obsessed by two fears—that he would be shot as an objector and that the bogie of molten iron, which he hauled at his work, would upset and burn him to death. The Local Tribunal registered him for non-combatant service and the Medical Board rejected him entirely for psychiatric reasons. The torticollis persisted and, in response to a direct question, the patient admitted he now feared that his rejection might not be permanent but subject to review. In September, 1942, he still had a severe torticollis and had been able to do only a few weeks' work.

CASE 7.—*Schizoid state:* A fuller account of this case will be found in a paper on "Panic States in Civilians" (Stalker, 1940, Case 3).

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The patient's father had a nervous breakdown as a young man and still has gastric symptoms. In the last war the father served only at home, as his vision was defective. He was a strict parent and the patient was afraid of him. The mother died of heart disease when the patient was 15 and some of his bodily symptoms resembled those of his parents. A brother also is in the Methodist Peace Fellowship and is an objector. The patient's earliest recollection is of seeing the damage done to buildings in an air-raid during the last war. As a child he had a number of anxious symptoms, yet he also showed slight behaviour disorders. His work was prosaic and his idealism turned into Church activities. For a time he drank and had a sexual liaison. There are many details of his rather double character upon which his later doubts about his motives might well be founded.

Two years before the war he joined the Methodist Peace Fellowship. For one year before the war he was constantly apprehensive of its coming, and pictured vividly to himself all its possible horrors. After the outbreak of war he suffered conflict between his views and those of the majority. He analysed in detail the origins, motives and purpose of his objection. Soon he analysed all his acts in the same way. He often concluded that his motives were unworthy and selfish. He had acute anxiety attacks, somatic anxiety symptoms, and obsessive thoughts of sexual and of religious kinds. There were bouts of depression in which something like a voice suggested he commit suicide.

He attended from December, 1939, to March, 1941, with only a few weeks of hospital residence and incapacity for work. The Local and Appellate Tribunals registered him for non-combatant service and the Medical Board rejected him entirely for psychiatric reasons. In September, 1942, he had married, was working well and was free of symptoms.

CASE 8.—*Anxiety state:* A coal-miner, aged 29, was admitted to Jordanburn in September, 1942. His father was a volunteer in the last war and has since suffered from an apparently organic deafness due to a shell explosion. A miner also, he has not worked since 1928 because of the deafness and because of a row with the management; he is an active member of the British Legion. The father occasionally drinks heavily. As a boy the patient received some thrashings and was generally afraid of the father. He was afraid of the dark, of heights, and of animals; he had nightmares and nail-biting; he was shy and had feelings of inferiority, yet at the same time was generally a very mischievous boy. The mischief was usually not serious, but he once was put on probation at the Juvenile Court for breaking into a shop.

Since leaving school he has worked as a miner and before 1942 was hardly ever idle or off sick. For eight years he worked in a wet and gassy section, where the roof frequently made a noise like thunder and all the men used to run lest it fall in. Actually nothing serious ever happened, but a number of fatal accidents have occurred in other sections. All the other men found this section a strain, and the patient, too, after working in it for five years, felt afraid and tired, had bodily pains, was sleepless and had nightmares of his work, so that he had to go to another section. Ever since he has been afraid of being put back into that section. He "had to get married" at age 19 because of the pregnancy of his wife, which however resulted in a stillbirth. The two following pregnancies were equally unsuccessful. For years the patient has been a keen politician, a Communist and a trade union official. In January, 1942, he had symptoms of a left medial meniscus injury, which was operated upon in June.

He registered as a conscientious objector on political grounds in April, 1940, as he opposed the Government in nearly everything. (He does not practise any religion.) After a talk with his father he withdrew his objection a week later. In April, 1941, he organized a two-day stay-in strike in his section of the pit in spite of the disapproval of his trade union, which threatened to expel him for it. He has always been quick-tempered and occasionally drank too much. Three weeks before admission he had to work in the bad section for a few hours and he was intoxicated that night; the next day he saw some soldiers fighting among themselves and at once developed an obsessive thought of killing his wife, which persisted until his admission. The obsession has already gone, but some anxiety remains and he is at present afraid to return to coal-mining.

There are three features found in almost all the cases in all three groups:

(1) *Aggression.*—It is noteworthy that in all of the cases aggressive trends appear more or less openly either in the previous personality or in the illness. It is of interest here to recall the views of Glover on pacifist activities (1935), although he was not writing specifically about conscientious objection. I quote: "Peace and war activities are both solutions of mental tension, the apparent and actual differences being due to the different defensive mechanisms employed. The driving energy in both cases belongs to the destructive group of instincts, in particular that variety which when fused with some love components is known as sadism. In illustration, the fanatical pacifist under certain circumstances may be a danger to peace."

In this series aggressive trends are seen as follows: In Case 1 in the obsessional ideas of harming others; in Case 2 in the symptom of striking other patients; in Case 3 in the delusions of influencing others and inverted as thoughts of suicide;

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in Case 4 in the ideas of omnipotence, which may have been derived from aggressive tendencies; in Case 5 in all his antisocial behaviour; in Case 6 in his previously disordered behaviour; in Case 7 in the previously disordered behaviour and in the thoughts of suicide; and in Case 8 in certain aspects of his previous personality and in the obsession of killing his wife.

(2) *Pathological fear.*—Pathological fear is clearly shown in the previous personalities and in the illnesses of Cases 1, 3, 6, 7 and 8. In Case 2 it may be inferred from the previous personality and from the circumstances of the onset of the illness. In Case 4 it is seen in the previous personality, for which the illness may be a compensation. In Case 5 there was only slight fear in childhood. It is not surprising to find pathological fear in individuals who at the same time show strong aggressive trends. Pathological fear is often a fear of the subject's own unconscious impulses. It may well be that in some of these cases the fear of the release of strong aggressive tendencies has been an important factor in the genesis of the objection to combatant service which implies release of aggressive impulses.

(3) An important factor is that in seven out of the eight cases the reactions of the fathers to military service in the last war had been very uninspiring if not abnormal. In Cases 1 and 2 the fathers had been psychiatrically unfit for service; in Case 5 the father was in a reserved occupation and is "against war"; in Case 4 the father was too old to serve; in Case 7 the father was on home service only; while in two cases (3 and 6) where the father had combatant service he developed psychiatric symptoms said to be partly due to that service. That leaves only Case 8 in which the father performed full service and had no psychiatric sequelae. In another case—not reported because only once seen—the father was an objector in the last war and all three sons are objectors in this one.

I think that the histories permit one to infer that in these psychiatric cases the conscientious objection was but one of several similar manifestations of the patient's previous personality, and in several, of the later psychiatric reaction as well. One may ask further whether conflicts arising about objection had in their turn aggravated the psychiatric state. This could occur either as conflict about *whether to be* an objector or as conflict about *being* an objector. In Case 4 there was great conflict about whether to be an objector. In Case 7 there was great conflict about both "whether" and "being." In some other cases there was a little evidence of such aggravation; in Case 3, conflict about his "conscience" apparently before being an objector; in Cases 5 and 6 the alleged belief that the patient would be shot as an objector; in Case 8 the patient withdrew his application after a discussion with his father. In Cases 1 and 2 no evidence was obtained of any such conflicts.

The case material presented shows that in some cases conscientious objection may be associated with an abnormal mental condition, and I would make a plea that Tribunals for Conscientious Objectors and Recruiting Medical Boards should be on the watch for such cases, so that full justice may be done to them on the basis of their mental conditions.

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THE SUBCONSCIOUS IN STORY WRITING.

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THE following story was written by a woman writer while convalescing from an attack of melancholia. She had written it for publication as a short story for children.

When I read it, I was certain that it was a deliberate piece of autobiography, written in the form of a fantasy. I was therefore much surprised on putting this to the author to be told that it was not supposed to have any reference to herself whatever. Without any attempt at serious analysis it was not difficult to convince her of the real significance of her story, and it is such a good example of the part the subconscious plays in the writing of such stories that it seems worth recording.

The story which follows is exactly as written, but I have divided it into numbered sections for ease of reference.

THE JOURNEY.

Section 1.

Just as the sun rose over the hill, the woman set out from her home. She was given a small lantern, already lit. "But I don't need this," said the girl—"look, the sun is just rising." "You never know where you will be when the night falls," came the answer. So off she set with her little lantern.

Her way led through a wood, along a mossy path by the side of a river, and she watched the water flowing over the stones. Soon the path led into an open meadow, and when the sun grew hot, she took off her shoes and stockings and sat on a stone, and put her feet in the water. As she sat there with her lantern beside her, a man came along, and stopped to greet her. He sat down and shared his bread with her and they talked. She saw from the dust on his clothes and his worn shoes that he had travelled very far. So she asked him of his journey and he told her gladly—of seas he had crossed, of cities with many people and of great travellers he had met on the way. And she watched his face and lived with him, in his story.

When they had eaten, they rose, and travelled along the way together. The road left the meadow, and crossed a moor surrounded by hills. They came to a fork in the road and the women's way lay straight on, but the man said, "Come along my path a little way and it will lead us up into the hills and so you will get a fine view of the rest of your journey." So she left her lamp at the fork of the road and went with him.

In late afternoon they reached the hill-top and sat with their backs to a stone wall and looked into the valley through which her road wound. And it lay in clear sunshine beneath them, so that they could see every curve of the road, until it led round a brow of the hill, and was lost to sight. And the man continued the story of his journey and his adventures, and while her ears drank in his words, her eyes were filled with the beauty of the sunlit country below. And when he was silent they listened to the sound of the shepherd calling in his dog—and they were at peace. And looking at him, she loved him deeply for the adventures he had survived and for the days through which he had battled.

Section 2.

And now the sun was drawing in to the horizon, so they arose and in sadness parted and he went his way, and she turned to go down the hill again. Yet when

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she came to the fork in the road where she had left her lantern, she found it had gone out. As she picked it up she saw that the oil had been spilt on the ground. Then she noticed a troupe of people sitting on the top of a fence and laughing at her. She was indignant, and holding her extinguished light in one hand, walked up to them and asked if they had spilt her oil and put out her lamp. They answered, " If you leave your lantern by the roadside anyone coming along may kick it over by mistake." And, not noticing her distress, they went on their way till their jeering voices were lost among the hills and in the lessening light she could no longer see them.

Her anger and sorrow had wearied her; but most her anger against herself that she had not cared or bothered about the light and that she had stayed so long talking on the hillside. She turned to go her way heavily; darkness falling, the light of no house twinkling to greet her as a possible lodging.

Section 3.

As she walked on, she saw in the dimming light a figure before her, sitting on a stone by the roadside. He seemed in the fading light to be almost part of the rock so old and still he was. She hesitated to pass so near him in the twilight, but he lifted his head slowly and looked at her, and in that look she was reassured. For in his face was written such a great age of wisdom, such a knowledge of suffering, such a deep kindness sprung from all he had seen upon his journeyings, that her fear left her and she put her empty lantern at his feet and sat down on the grass beside him. The dew was falling, and the grass was already damp to her hand. Sitting in silence beside him she was struck by the very great peace which flowed from him, and her great agitation at parting from her friend and finding the lantern had gone out seemed out of place. Her body and heart relaxed in the shelter of his great age, and tears came silently and poured down her face. The old man slowly lifted his very frail old hand and touched her on the shoulder saying, " I know, I know "—and then was silent again. She told him of her fears and anger, of her friend and the hill they had climbed together, of her leaving the lamp, and she ended, " Now the darkness has come upon me—I have no light and nowhere to stay the night." She looked up into his face, expecting great kindly sympathy. But the old man looked at her with eyes which saw all and said, " Yes, you've been very silly." " But what can I do now ? " she asked. " I can't sit here all night and I can't travel on in the dark." Then said the old man, " You'll have to go to the land of those who have no light." " But if I go there," she said " perhaps I'll never return." He reiterated, " Perhaps you'll never return," and stood up and took his staff and with no more talk went on his way. When she could hear his footsteps no more she rose and taking again her empty lantern in her hand, groped forward in the dark, feeling for the hardness of the road under her feet.

Section 4.

Soon she heard the noise of running water and walked warily lest she fall into it. Then right across her path she found a great river flowing, and there was no way to cross it.

And for long she stood in the darkness and listened to the sound of the river flowing and heard the strange creak of swans flying overhead. Then above the sound of the water she heard the splash of oars, and out of the darkness came a boat, with one figure rowing. She called and he drew into the shore and she told him how she was bound for the land of the people who had no light. The oarsman told her that he would take her across and she stepped into the boat and pulled from the shore. They drifted down the river in the strong current and the oarsman dipped an oar lazily in the water now and then as though he did not mind which way he should go.

Once in midstream, she heard muffled cries from the shore they had left, and she would have gladly gone back to warm herself in the company of other travellers, but the oarsman never heeded, but let the boat drift down the stream.

Then said the woman: " You told me you would take me across the river, but look, we drift down stream. Shall we never reach the other side ? " And the oarsman made no answer and she could not see his face in the dark, but from the shape of his shoulders against the lighter shore, she more than felt a scowling visage.

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Then she grew fearful and shouted at him, " Row, man, row ; we drift endlessly." And she stood up and made for the stern of the boat, that she might help to steer by the rudder. But the oarsman said : " This boat has no rudder. Those whose light has gone out can no longer steer." At that she stood up in the boat and said, " True, my light is gone out ; true, I cannot steer if there is no rudder ; true, too, that you will not help me to reach the farther shore—but I can at least swim and trust that these dark waters will bear me up." So, leaving her empty lantern behind, she threw herself over the side of the boat. The waters met over her head and, before she came to the surface, she felt how quickly the current ran, drawing her downstream ; the water was even bitter to her tongue, and stinging to her eyes. But she struck out for the shore, saying within herself, " There is but my will against this might of water and of great darkness overhead. If I drown I am spared further voyaging ; if I win to shore I shall count future perils as little after this one."

But the great cold tightened on her limbs, drawing her will from her, till each stroke grew more feeble and quicker than the last and finally she sank, with a great buzzing in her ears, and the darkness of the night and of the bitter water entered into her, so that she and they were one.

Section 5.

To this darkness came later the sound of voices ; and careful hands were upon her body, warming it and re-clothing it. But her body was of no consequence, because the darkness of the river and of the night was within her. The sun rose and she saw she was on the further bank ; but the light of the sun and the care of those around her was as nothing, for the darkness of the river and the night was within her. But when the sun rose higher and her body grew warmer, she arose and said : " Darkness or no darkness, I must journey on," and she turned her feet into the land of those who had no light.

And often on her way, to make the helpless, hopeless time go faster, she talked with other people wandering through the land, and their plight and her plight were similar, and often they sat in great herds by the roadside, and mourned together. And it was then that they seemed but one body of huddled sorrow and fear. And the woman raised her voice within her, and cried on the hills round, on the birds flying overhead, on the sky, on the rising and setting sun. " Where can I turn ; within is great blackness ; without is this deadening rhythm of coming day and darkening night. Even were the darkness to be taken from me, yet forever will go with me the remembrance of those who travel with no light." And the thought and look of her hopeless companions became a weight too great to be suffered—so one night when they had all settled down by the roadside for the night and covered their heads with their cloaks, she determined that before dawn the next day she would rise and journey on alone.

Section 6.

So before the first light, she arose and stepped carefully over the sleeping forms and continued alone on her way. When the sun came up over the hills her heart was lightened a little at being alone again, and she saw before her, sitting at the roadside, the old man whom she had met so many days before on the other side of the river. And she was filled with shame and covered her head with her cloak to walk by unrecognized. But he called her and she let drop her cloak and looked at him again, deeply glad of a chance to see such quietness and wisdom written on a face. And he was looking out over the hills, the way she was to go and so she had a chance to look very long at his face, to read again the page of suffering on his forehead, the kindliness around his eyes, the gentle humour at the corners of his mouth ; and when he turned his head and looked at her she read in his face a very slow quiet joy. And looking very long at him the darkness within her drifted away as a wreath of mist might float away before the sun—and she was left empty of darkness. Then she said, " How can I journey on when all those others walk in darkness ? " and the old man said, " They will all come along this way, and meet me even as you have," and at that he smiled, seeming to be thinking of all those who would pass him as he sat by the road. And at his smile her emptiness was filled with light. She said, " I left my lamp behind. It had no oil, I couldn't light it again." And the old man answered, "Anyone who has travelled this far, needs

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no lamp. By day your own eyes will guide you. At night, cover your head with your cloak and wait for the sun; in stormy weather, take cover under a rock and wait gently till the storm goes past. Both your hands are free now so you can walk easier." And at that he rose and moved away, and the woman went on her way, hoping to see him again before the journey was finished.

The patient, now aged 32, while still an undergraduate at Cambridge, married a German musician. They lived in Germany and two children were born of the marriage.

Section 1.

After the birth of her first child, she fell in love with an artist and lived with him for a year in the Austrian Tyrol. This liaison is described in Section 1, where the woman wanders from the main highway of life, leaving her guiding lamp behind, and climbs into the hills with her fellow traveller. The artist, like herself, had been a great traveller—this, in fact, had been one of the bonds between them. One of the patient's best known books is one in which she describes some of her travels.

Section 2.

In Section 2 is described the patient's return to her husband and her former social circle. The jeering and self-reproach of the fantasy she had no hesitation in relating to what actually took place at this time of her life, her memory of these happenings being very vivid. She returned to live with her husband, and following the birth of her second child she had a short attack of melancholia.

Life in Germany under Hitler became increasingly difficult for her as an Englishwoman, and in 1938 she returned to this country, bringing her two children. By mutual arrangement this led to her husband divorcing her for desertion. Shortly after her return to England she started a liaison, the result of which was the birth of an illegitimate child. As with her first liaison, so with this, a degree of ostracism inevitably arose and her self-reproach passed into a frank attack of acute melancholia. In the fantasy the two liaisons are combined, the description being of the first, while the time sequence belongs to the second.

Section 3.

In Section 3 the old gentleman described is the father of the patient. He is a highly cultured man of the world and a former Cabinet Minister. The patient has in fact a strong father fixation and always has taken her troubles to him and, as in the story, she has always found him most comforting and helpful.

In her first breakdown she thought the child was her father's, and during her present attack she wrote: "Personally I got muddled in the relationship between my father and mother. I seemed to be becoming her, instead of myself."

Towards the end of this Section reference is made to the occasion when her father told her that her behaviour had been most foolish and that her illegitimate pregnancy might well lead to another mental breakdown as had her previous pregnancy. The land of those who have no light, as the story subsequently shows, is the land of the mental invalid.

Section 4.

In Section 4 she describes her loss of faith in her family doctor and her resolve that suicide was the only solution. Her depression came on after the birth of her child and after a week, in which there was much talk of suicide, she one day ran out of the house and threw herself in front of a lorry. It was this suicidal attempt which led to her admission to the Crichton Royal.

In a letter, early in her convalescence, she wrote: "Before my attempted suicide, I thought this great gulf in me and in the world between the material and spiritual worlds could be bridged through death; that my sins were so many and complicated that I might help by being no more."

The "great gulf" of this letter she now identifies as the "great river" of the story.

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Section 5.

Section 5 tells of her feelings following her suicidal attempt and of how when first in hospital "on the further bank" she felt utterly hopeless, "because the darkness of the river and of the night was within her."

In the letter, already referred to, she says: "After my attempted suicide, time seemed to slow down, so that in a second was eternity; my soul was, to put it bluntly, in hell, i.e., cut off from connection with the spirit of God. The light of life was gone and nothing could relight it."

Section 6.

Here she describes her gradual improvement and her awareness of her fellow-patients. It seems strange that even here the writer of the fantasy had no appreciation that she was describing her fellow patients; or that in Section 6 she is describing so exactly the first visit of her father—a visit made when she was beginning to show some lightening of her depression. Her father is a wise, understanding man, whose advice she had always sought and appreciated, just as in the fantasy.

It is particularly striking that even in writing this part of her story, which was describing such recent history, she was totally unaware of its significance, or in fact that it referred in any way to her father or herself.

In the above no attempt has been made to analyse the material of the story, or to relate the significance of its many details, as revealed by subsequent free association and other psychological procedures. All that has been attempted is to give enough detail of the patient's history to convince the reader of the patient's identity with the woman of the fantasy and of the identities of some of its other characters.

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THE SHIPLEY-HARTFORD RETREAT SCALE FOR MEASURING INTELLECTUAL IMPAIRMENT.*

A PRELIMINARY COMMUNICATION.

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FOR many years the need has been felt for a means of measuring in a reasonably accurate manner the amount of deterioration present in mental patients.

The old criterion of saying that a patient is well because he is capable of working well in the laundry or garden or doing skilful work in the handicrafts department, combined with giving an impression of recovery to the doctors and relatives, is not accurate enough for modern standards.

To estimate deterioration it is necessary to assess the intelligence level of the patient when he was well and at his best, and compare this with his power of abstract thinking at the time of examination. Deterioration means an irreversible diminution in intellectual capacity, a true deterioration, or as some may care to call it, dementia, which cannot be recovered from. Babcock (in 1941) in her book *Time and the Mind*, says: "The distinguishing characteristic of intelligence is . . . the potential degree to which one can abstract and generalize, can express these functions symbolically and use these symbols in future thinking."

In 1930 she was the first to produce an examination aimed at estimating the amount of deterioration, but her work has never been carried very far, probably because of its time-consuming nature. She later pointed out, in 1931, that the important practical result is the difference between the individual's normal intelligence and his present efficiency. The former is obtained by the vocabulary test, the latter by a series of efficiency tests which really estimate the power of abstract thinking. She applied her work to dementia praecox patients and in 1933 published her results, comparing 206 dementia praecox patients with 216 non-psychotic subjects. She found that in the early stages there was shown what she called "retarded associations," and a pronounced learning defect which was probably secondary to the retarded associations.

Wittmann in 1933 published his results, using the Babcock Test in an American State Hospital. He found that it gave an indication of other patients' present efficiency. In several cases which showed considerable improvement on re-testing, there was still emotional reaction and behaviour which was childish and inappropriate.

Dearborn in 1934 pointed out that the deterioration met with in psychoses is shown by a lessening of the power of memory and recall, a derangement of conceptual association which gives rise to a tendency to avoid concrete thought, lessening of personal purposiveness and impairment of judgment.

Harbinson in 1936, using the difference between the Terman Vocabulary Test and the Visual Perception Tests of General Ability, found that in more than 70 per cent. of schizophrenics there was no deterioration, whereas in 80 per cent. of 15 melancholics there was deterioration.

In 1940 Shipley extended the method used by Babcock, replacing the so-called efficiency index of Babcock by what has come to be known as the conceptual quotient. Shipley concentrated on the function of abstract thinking, and the second half of the Shipley-Hartford test is considered by its author to be a test of abstract thinking.

* Read at the Spring Meeting of the South-Western Division of the Royal Medico-Psychological Association held on April 23, 1942, at Barnwood House, Gloucester.

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NAME .....

In the test below, the first word in each line is printed in capital letters. Opposite it are four other words. *Draw a line* under the *one word* which means the *same thing*, or most nearly the same thing, as the first word. A sample has been worked out for you. If you don't know, *guess*. Be sure to underline the *one word* in each line that means the same thing as the first word.

		sample			
	LARGE	red	big	silent	wet
			begin here		
(1)	TALK	draw	eat	speak	sleep
(2)	PERMIT	allow	sew	cut	drive
(3)	PARDON	forgive	pound	divide	tell
(4)	COUCH	pin	eraser	sofa	glass
(5)	REMEMBER	swim	recall	number	defy
(6)	TUMBLE	drink	dress	fall	think
(7)	HIDEOUS	silvery	tilted	young	dreadful
(8)	CORDIAL	swift	muddy	leafy	hearty
(9)	EVIDENT	green	obvious	sceptical	afraid
(10)	IMPOSTOR	conductor	officer	book	pretender
(11)	MERIT	deserve	distrust	fight	separate
(12)	FASCINATE	welcome	fix	stir	enchant
(13)	INDICATE	defy	excite	signify	bicker
(14)	IGNORANT	red	sharp	uninformed	precise
(15)	FORTIFY	submerge	strengthen	vent	deaden
(16)	RENOWN	length	head	fame	loyalty
(17)	NARRATE	yield	buy	associate	tell
(18)	MASSIVE	bright	large	speedy	low
(19)	HILARITY	laughter	speed	grace	malice
(20)	SMIRCHED	stolen	pointed	remade	soiled
(21)	SQUANDER	tease	belittle	cut	waste
(22)	CAPTION	drum	ballast	heading	ape
(23)	FACILITATE	help	turn	strip	bewilder
(24)	JOCOSE	humorous	paltry	fervid	plain
(25)	APPRISE	reduce	strew	inform	delight
(26)	RUE	eat	lament	dominate	cure
(27)	DENIZEN	senator	inhabitant	fish	atom
(28)	DIVEST	dispossess	intrude	rally	pledge
(29)	AMULET	charm	orphan	dingo	pond
(30)	INEXORABLE	untidy	involatile	rigid	sparse
(31)	SERRATED	dried	notched	armed	blunt
(32)	LISSOM	moldy	loose	supple	convex
(33)	MOLLIFY	mitigate	direct	pertain	abuse
(34)	PLAGIARIZE	appropriate	intend	revoke	maintain
(35)	ORIFICE	brush	hole	building	lute
(36)	QUERULOUS	maniacal	curious	devout	complaining
(37)	PARIAH	outcast	priest	lentil	locker
(38)	ABET	waken	ensue	incite	placate
(39)	TEMERITY	rashness	timidity	desire	kindness
(40)	PRISTINE	vain	sound	first	level

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NAME .....

Complete the following. Each dash (_) calls for either a number or a letter to be filled in. Every line is a separate item. Take the items in order, but don't spend too much time on any one.

start here

(1) 1 2 3 4 5 _

(2) white black short long down _ _

(3) AB BC CD D _

(4) Z Y X W V U _

(5) 1 2 3 2 1 2 3 4 3 2 3 4 5 4 3 4 9 6 _ _

(6) NE/SW SE/NW E/W N/_

(7) escape scape cape _ _ _

(8) oh ho rat tar mood _ _ _ _

(9) A Z B Y C X D _

(10) tot tot bard drab 537 _ _ _

(11) miss is wasp as pint in tone _ _

(12) 57326 73265 32657 26573 _ _ _ _ _

(13) knit in spud up both to stay _ _

(14) Scotland landscape scapegoat _ _ _ _ee

(15) surgeon 1234567 snore 17635 rogue _ _ _ _ _

(16) tam tan rib rid rat raw hip _ _ _

(17) tar pitch throw saloon bar rod fee tip end plank _ _ _ _ _ meals

(18) 3124 82 73 154 46 13_

(19) lag leg pen pin big bog rob _ _ _

(20) two w four r one o three _

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In the first results Shipley found that in a group of private mental patients showing no deterioration, the Babcock test and his own gave the same results. In the remaining groups the abstract thinking scores were considerably the lower.

In the first section of the Shipley-Hartford test the number correct is taken, but one mark is given for each four items not attempted and in the second section the number correct is multiplied by two. Then from the table the conceptual quotient is determined.

At the same time a scale of mental ages has been constructed by the author in which the mental age can be read off a table either from the vocabulary or from the abstract thinking or from the sum of both.

The conceptual quotient (C.Q) is the index of deterioration, and is the ratio of the subject's abstract thinking age to that of a normal person with the same vocabulary score. It is multiplied by 100 to avoid decimals. A conceptual quotient of over 90 can be regarded as normal, one between 80–90 as border-line, between 70–80 as very doubtful and below 70 as certainly pathological. The experience of Shipley and of Pollack in 1942 has shown that a vocabulary score of below 23 is of doubtful use, as the C.Q. of subnormals is not valid. Scores above 90 merely show that the subject's ability to think in abstract terms has not become impaired. Shipley and Burlingame in 1941 found the test useful in measuring intellectual impairment in relatively early cases of average or superior intelligence. They consider that it is not suitable for markedly deteriorated cases or for subnormals.

In the April, 1942, number of the *Journal of Mental Science* Brody published a paper on the measurement of dementia. In this he comments that the Shipley-Hartford test appeared too late for his own investigation, that it had the merits of simplicity and brevity and that it would probably be deservedly popular. He draws attention to a fact which applies to all mental tests—that the causes of failure may not be intellectual.

The test has a great deal to recommend it, especially where time is valuable. It can be self-administered and so used on large numbers at the same time. There is no checking of half-seconds, seconds or any other measures of time except the 10-minute limit for the whole of each section (or 5 minutes for the half section). It is easily checked and scored, and there is no calculation to make; the results are read from a table. The test can be divided into two halves, using alternate items, so that 20 words and 10 items can be given before treatment and the others afterwards for comparison.

In applying, as we have done, this test to cases of depression it is important to realize that in trying to estimate the ability of a patient to think in abstract terms, we have to make allowance for the possible interference of inhibition. The patient

Patient.	Age.	Sex.	Occupation.	Diagnosis.	Duration of illness in months.	C.Q.	Vocabulary mental age.	Abstract thinking mental age.
Da.	51	M.	Wholesale tobacconist	Invol. mel.	36	63	19·4	13
Pr	62	M.	Ironmonger	,,	60	65	17·0	11
Ma	72	M.	Physician	,,	3	59	21·0	10·5
Wk	72	M.	Head of prep. school	,,	72	62	20·6	11
Fr	64	M.	Bank manager	,,	24	72	13·9	10·5
Le	49	M.	Works manager	Recent mel.	10	88	20·2	15·7
Ja	59	M.	Company director	Chronic mel.	168	77	11·1	8·0
Sa	63	M.	Bank manager	Invol. mel.	18	72	17·4	12·5
De	66	M.	—	,,	51	77	17·0	13·0
Lo	59	M.	Physician	,,	30	62	21·0	11·0
Dan	65	M.	Leather manufacturer	,,	12	73	14·7	11·0
Ca	45	F.	Ind. means	Mel.	56	62	17·8	11·0
Wi	70	F.	,,	Chronic mel.	128	70	20·2	12·5
Jo	61	F.	P.O. official	,,	64	106	21·0	18·0
Wh	55	F.	Ind. means	Recent mel.	20	65	19·4	11·5
Co	41	F.	Housewife	Recurrent mel.	15	65	19·8	10·5
Lo	50	F.	,,	Invol. mel.	31	83	14·3	12·0
Le	49	F.	Ind. means	Recurrent mel.	12	59	19·4	10·5
Bo	59	F.	,,	,,	43	111	20·6	13·6
Ho	40	F.	,,	,,	24	73	21·0	1·30

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may make a poor score on the abstract thinking test because he is so inhibited that he is unable to cope with the test in the time available. Incidentally the time allowed is on the generous side.

Simmins in 1933 and again Harbinson in 1936 found that about 80 per cent. of their cases of melancholia showed an impairment of abstract thinking—in other words, some deterioration. It is possible that this may not be deterioration at all. If a melancholic can be cured and when cured shows no impairment of abstract thinking there can have been no deterioration. Neither Simmins nor Harbinson quote any figures on cases of melancholia which have recovered.

Simmins (1933) found in one group of 17 depressives, all of whom were over 50, an average vocabulary age of about 15·4 and on G score for deterioration, 13·64. In another group of 33 depressives, probably of better education, the average vocabulary score was 15·6 and on G score for deterioration, 15·9. She herself states that in this second group of 33 depressives deteroriation was only present in 15 per cent. These statements are rather contradictory, and suggest that there is need of some investigation of the presence or otherwise of deterioration in cases of depression.

Our own results in 20 cases of melancholia are shown in the table. Only two of these cases are over seventy, so that deterioration due to age need not be considered as a factor. March (1933) has shown that there is only a slight tendency for human adaptability to decrease with advancing age.

There appears to be a lowering of the conceptual quotient in melancholia to a level which is regarded as pathological. It remains to be shown whether electric shock treatment and prefrontal leucotomy will be able to restore this low quotient to a normal level. If this happens, then there is no real deterioration in melancholia, only an apparent one.

Our thanks are due to Dr. C. C. Burlingame, of the Neuropsychiatric Institute of the Hartford Retreat, Connecticut, and to Dr. Shipley for permission to reproduce the test.

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SPINAL ANAESTHESIA IN ELECTRICAL CONVULSIVE THERAPY.

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THE value of electrical shock therapy is becoming increasingly recognized and used by psychiatrists in the treatment of depressive states, particularly of the involutional period, states of depersonalization, and to a lesser extent in schizophrenia. One of the major objections to its use, however, has been the complication of fractures, generally crush fractures of the bodies of the mid-dorsal vertebrae (thoracic 4–8), and uncommonly that of limb bones, such as the femur. Another aspect of this problem arises with the occasional case in which the use of shock therapy is desirable, but a previous fracture of the spine or limb bones, or marked bone disease with an increased liability of fracture resulting during treatment, acts as a deterrent to the physician. Even more so is the question of continuing treatment without further damage to the patient, should a fracture have unfortunately resulted before the full course of convulsions is completed. Various methods have been introduced to minimize or abolish the muscular pull producing fractures, including intravenous injections of curare, of concentrated magnesium sulphate solution, or of beta-erythoidin hydrochloride; spinal anaesthesia has been similarly employed.

The intravenous injections have a generalized muscular effect, while the protective action of the spinal anaesthetic is, of course, only on the thoracic and lumbar spine and the lower limbs.

None of these methods has proved entirely satisfactory, but this paper illustrates the decided value of spinal anaesthesia in cases where the problems mentioned above have arisen.

Numerous papers have been published analysing the incidence of vertebral fractures in different series of cases. With improvements in technique, such as keeping the patient's spine in a position of hyperextension and applying counter pressure to the hips and shoulders while allowing freedom of movement of the extremities, there has been a marked drop in the incidence of these fractures.

The first vertebral fracture following induced convulsions was recorded by Stalker in November, 1938, and in 1939 Polatin, Friedman, Harris and Horwitz recorded 43 per cent. vertebral fractures. This figure has been rapidly reduced by successive workers, such as the 23 per cent. of Easton and Sommers, 14 per cent. of Cook and Sands in 1940 without using hyperextension, down to the very low incidence of rate of 2 fractures in 112 cases recorded by Cheney, Hamilton and Heaver in 1941, using hyperextension. All workers agree that the vertebral fractures are usually found to occur between the 4th and 8th dorsal vertebrae, and that they are compression fractures with anterior wedging of the vertebrae. As stated by Worthing and Kalinowsky the general opinion is that the rigid mid-dorsal curvature becomes subjected to strong converging muscular forces which act above and below the dorsal region. It is also agreed that the incidence of vertebral fractures using electrical means is about a quarter that seen when metrazol (cardiazol) is used. One group by L. B. Kalinowsky had 10 per cent. vertebral fractures with electrically induced convulsions, compared with 43 per cent. when

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metrazol was used, all cases having sandbags placed under the mid-dorsal spine and the same radiologist and X-ray technician employed. Roberg, in studying the spinal changes, concluded that the forces exerted by tetanic muscular contractions produced compression fractures of the mid-dorsal vertebral bodies, usually those of the 5th and 6th dorsal vertebrae, in definite contrast to ordinary traumatic compression fractures which centre about the body of the first lumbar vertebra. There may be a predisposing factor, i.e. the possible presence of bone atrophy. In addition to vertebral fractures bilateral fractures of the femoral necks caused by metrazol-induced convulsions are recorded by Androps, Sommers and Richardson, and by Hemphill; and A. E. Bennett in 1941 recorded serious fractures of humerus and femur in 1·5 to 2 per cent. and dislocations in 17·2 per cent. The incidence of vertebral fractures is greater over 50 and under 20 years than between these ages. Thus it can be concluded that where X-ray of the dorsal spine shows a normal state of affairs and the patient's age is between 20 and 50, with recent improvements in technique, the routine use of spinal anaesthesia is unnecessary; but in cases where the above conditions do not hold, it may be a useful aid.

Hamsa and Bennett state: "The following is the prophylactic treatment to remove the potential forces of the lower extremity and spinal flexor muscular contractions: 30 minutes to one hour before induction of convulsion, 10 mgm. of pantocaine hydrochloride or 100 mgm. of procaine hydrochloride dissolved in 4 c.c. of spinal fluid obtained by puncture between L1 and L2 are injected.

"Transient anaesthesia with complete sensory and motor paralysis of all thoracic and lumbar segments wears off in about an hour after the convulsion. The convulsive shock ensues without contraction of the anaesthetized areas." We do not consider it necessary to produce complete motor paralysis of all the thoracic segments to avoid fracture; if a sufficient damping down of the force of muscular contraction is obtained, vertebral fractures will not occur. More so is this the case if hyperextension is used in addition; thus if, as we make a practice of doing, the spinal anaesthetic introduced effects a marked degree of motor paralysis no higher than D7, the undesirable results of the lowered blood pressure which follows the paralysis of the vasomotor fibres are avoided to a great extent, as also is the danger of respiratory embarrassment and failure which would be produced by paralysis of the intercostal muscles. The muscles involved, such as the abdominal muscles, the multifidus and the sacro-spinalis are largely put out of action, and there is little pull on the mid-dorsal vertebrae.

Technique.

The results obtained by the following technique were viewed from two angles: (*a*) The prevention of new fractures, and the prevention of further damage to old fractures or bone disease, such as Paget's disease, old tuberculous disease, osteo-arthritis, etc.; (*b*) the effect of repeated spinal anaesthetics at short intervals on the spinal cord and cerebro-spinal fluid. Stovaine (amylocaine hydrochloride) was used in all instances, made up according to Barker's formula: amylocaine hydrochloride, 0·10 gm.; glucose, 0·10 gm.; with distilled water up to 2 c.c. Specific gravity 1025. Thus a hypertonic solution of strong concentration was used. Ordinary precautions such as are used before any spinal anaesthetic were observed, namely a full preliminary physical examination, no food for some hours before, aseptic surgical technique. Novocaine 1 per cent. was used to anaesthetize the skin, subcutaneous tissues, and ligaments over the intervertebral space selected. Lumbar puncture was performed between L1 and L2, using a Howard Jones needle, the patient in a sitting-up position on the table. The C.S.F. pressure was measured and the fluid collected for examination. With each patient the first specimen was examined for Wassermann reaction, Lange's curve, cells and protein percentage, and the subsequent specimens were examined for cells and protein only. After each lumbar puncture 1·8–2 c.c. of stovaine, depending on the height and configuration of the patient, was introduced into the spinal canal and the patient laid flat on the table, which was then tilted to an 8° Trendelenburg position. An interval of roughly half an hour was allowed to elapse before the current was passed, and in this interval the patient was tested for motor and sensory paralysis, and the electrical apparatus (in this series the Strauss-Macphail apparatus was used)

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fitted up. Fifteen minutes after the injection of the stovaine the table was lowered to a horizontal position, the spinal anaesthetic being regarded as " fixed " by that time. As a rule the paralysis rapidly reached a level of D7. Immediately before the shock therapy was applied a rolled blanket or small pillow was placed under the mid-dorsal region so as to put the spine in a position of hyperextension. After each convulsion the foot of the bed was raised on blocks for a few hours and the usual treatment following a spinal anaesthetic was carried out. The patient is confused for a short but variable time, and it is found that as soon as he appreciates his surroundings the anaesthetized limbs have recovered their functions. In Case 2 below, where arteriosclerotic features were prominent, the blood pressure was recorded before, immediately after, and ten minutes after each convulsion. In addition to this technique described, use was made of a free oxygen supply after the convulsion by applying a B.L.B. mask in Cases 2 and 4. We consider that in cases of suspected myocardial insufficiency the use of the B.L.B. mask immediately after the convulsion is of definite value. Also 20 c.c. of 33 per cent. glucose were injected intravenously after the spinal anaesthetic, and before the current was passed in Case 2, so as to counteract possible ill-effects on the myocardium as a result of the convulsion. In Case 4, 2 c.c. of coramine were injected intramuscularly immediately after the convulsion for a similar reason. In all cases 70 volts on the Strauss-Macphail machine were sufficient to produce a convulsion. Where the patient was on heavy doses of sedative, such as sodium amytal, this was omitted the night before each treatment.

Case Reports.

Case 1.—Female patient, aged 60, suffering from a fairly severe depressive illness following an air raid which caused injuries necessitating amputation of both legs. On X-ray it was found that she also had a traumatic crush fracture of the 2nd and 3rd lumbar vertebrae and some arthritic changes in the dorsal spine. A course of convulsive shock therapy with the aid of spinal anaesthesia was decided on. She had nine spinal anaesthetics followed by convulsions, at intervals of three days to a week, using 1·8 c.c. stovaine on each occasion. The C.S.F. pressure was normal throughout; the first specimen showed no cells and 20 mgm. per cent. protein, whilst the final specimen (i.e. after nine spinal injections) showed 17 lymphocytes per cmm. and 50 mgm. per cent. protein. Throughout the course of treatment the patient complained of no symptoms and showed no signs referable to the C.N.S.; and the final X-ray showed no change on the first one. She was discharged four months after admission, much improved.

Case 2.—Male patient, aged 54, was admitted suffering from a depressive illness with hysterical features. He had a forcible apex beat, blood pressure 190/110 mm. Hg; the peripheral vessels were hardened; the cranial nerves and reflexes normal; some rigidity of the limbs, and a persistent tremor. A diagnosis of arteriosclerotic Parkinsonism was made. His blood pressure varied between 170–200 mm. Hg systolic and 105–115 mm. Hg diastolic. In this case it was thought that preliminary spinal anaesthesia would, in addition to its protective action, lower the blood pressure, and it was found that after stovaine was injected and before the current was passed there was an average drop of 20–30 mm. Hg in systolic readings. The blood pressure rose during the convulsion to an average reading of 170–180 mm. Hg systolic, and fell again to the earlier reading ten minutes after the convulsion. His ordinary blood-pressure reading after completion of treatment was 145/95 mm. Hg. The cerebro-spinal fluid reports were of much interest in this case. Seven spinal administrations each of 2 c.c. stovaine using technique as described were given at intervals varying from three days to a week. The Wassermann reaction was negative, and C.S.F. pressure within normal limits. The specimen after the first anaesthetic had 81 lymphocytes per c.mm. with 40 mgm. per cent. protein. The reports after the next two anaesthetics gave lymphocytes plus with a positive Pandy reaction. After the fifth stovaine injection there were only nine cells per c.mm., but after the seventh spinal anaesthetic the cell count rose to 229 per c.mm. with small lymphocytes predominating and 80 mgm. per cent. protein. This patient made slow progress, but a contributory factor was domestic difficulties. There were no symptoms attributable to the spinal anaesthetic and no abnormal physical signs. Patient showed no ill-effects some months later.

Case 3.—Female patient, aged 42, admitted suffering from depression. She had an old tuberculous lesion of the left hip, which had been in plaster for months at a time. The X-ray report on admission stated: " Left hip shows destruction of head of femur and acetabulum with bony ankylosis. Spine normal apart from arthritic lipping. Abdomen shows calcified mesenteric glands and there is a calcified focus in the chest." Three spinal anaesthetics each of 1·9 c.c. stovaine were administered preliminary to passage of current at weekly intervals. The C.S.F. was not under pressure, did not show any cells, and had 20 mgm. per cent. protein before treatments began. There was no change in the C.S.F. after each spinal anaesthetic, and final X-ray showed no change. Patient was discharged recovered with no abnormal physical signs or symptoms.

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CASE 4.—Male patient, aged 50, was admitted suffering from recurrent depressive psychosis. Intravenous cardiazol was used without spinal anaesthesia, and with the first convulsion a chip fracture of the left acetabulum occurred. The hip was put up in plaster for a fortnight, and with further treatment no disability resulted. He was given seven spinal anaesthetics followed by convulsions induced electrically, and he was discharged from hospital recovered. Stovaine was used in each instance and the final C.S.F. reading was—Wassermann reaction negative, cells 5 per c.mm., and protein 30 mgm. per cent. After some months at work patient's symptoms returned and he was readmitted. An X-ray taken soon after was reported on as " Paget's disease of left ilium involving left acetabulum with diminution of joint space. Pieces of bone detached from upper rim are still ununited. Kyphosis of thoracic spine with arthritic changes. No Paget's disease of spine." We gave this patient nine spinal anaesthetics each of 2 c.c. stovaine, using technique described, at intervals of three days. Apart from a mild headache no complaints were made. The C.S.F. pressure was within normal limits throughout and the first specimen of fluid (before the first injection of stovaine in this second series) showed no cells and 20 mgm. per cent. protein. After the first injection there were 2·3 cells per c.mm. with no excess protein, after the second injection 1·6 cells per c.mm. and no excess protein. The cells rose to 6 per c.mm. (small lymphocytes) after the third anaesthetic with a slight excess of protein, and after the fifth injection the cell count was 36 cells per c.mm. (majority small lymphocytes) and moderate excess protein. After the seventh spinal injection the cells fell to 13·6 per c.mm. with slight excess protein, and after the final anaesthetic examination gave 38 cells per c.mm., and slight excess protein. A specimen taken nine days later without using anaesthesia showed the spinal fluid practically back to normal, namely 6 cells per c.mm. and 25 mgm. per cent. protein. On physical examination there were no abnormal signs as a result of the anaesthetics. Patient made a good recovery. A specimen of C.S.F. taken two months later was normal.

DISCUSSION AND SUMMARY.

1. It is not uncommon in hospital practice to find patients recommended for convulsive shock therapy who have a history of previous traumatic injuries to the spine or limb bones, or previous bone or joint disease, such as tuberculosis, arthritis or Paget's disease, hence rendering the use of spinal anaesthesia a distinct aid. The cases described were seen in the same hospital within the last year, one with traumatic fracture of lumbar vertebrae, another with an old tuberculous disease of hip, and a third with Paget's disease of the ilium with an ununited fracture of the acetabulum following convulsive therapy without spinal anaesthesia.

2. The effect of repeated injections of stovaine is not necessarily deleterious; it may give a mild meningitic reaction which is temporary, the reaction tending to increase with the number of anaesthetics administered. This does not result in abnormal symptoms and signs in the C.N.S.

3. Stovaine is a hypertonic solution of high concentration generally regarded as an irritant to the tissues. It is therefore of interest to find it has no apparent harmful effect if often repeated.

4. A possible use of spinal anaesthesia in cases of hyperpietics requiring convulsion therapy to help avert possible vascular catastrophes is indicated by successful result in the second case.

5. The administration of oxygen by the B.L.B. mask immediately after the convulsion, and the intravenous injection of glucose before the convulsion, are suggested as useful aids in myocardial insufficiency.

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EXPERIENCES IN THE TREATMENT OF DEPRESSIVE STATES BY ELECTRICALLY INDUCED CONVULSIONS.

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When von Meduna in 1935 introduced convulsion therapy, his hypothesis that schizophrenia and epilepsy were incompatible diseases suggested that convulsion therapy was applicable only to cases of schizophrenia. Similarly, Sakel, when introducing insulin shock, proposed it as a treatment to be applied essentially to schizophrenia. It is thus not surprising that most psychiatrists at first devoted their main attention to comparing the results obtained from treating schizophrenia by these alternative methods of " shock " rather than in studying their effects on other forms of psychosis. However, Low and co-workers (1) in 1938 reported having obtained very encouraging results from giving metrazol-induced convulsions to a group of sixteen manic-depressive cases, and very shortly afterwards Bennett (2) issued a preliminary report on ten cases of the depressive psychosis in which he stated he had found a remarkable improvement following cardiazol convulsion treatment.

In 1938 Cerletti and Bini (3) published a method which they had discovered of inducing convulsions by electric shock, and in the following year Kalinowsky (4), who had worked with Cellini and Bini at Rome, produced the first paper in this country describing the apparatus and its mode of application. Three weeks later Fleming, Golla and Grey Walter (5) described a British apparatus, made to Grey Walter's specification, having several advantages over that used by Cellini and Bini, and at the same time Shepley and McGregor (6) described a further apparatus having similar advantages. Both these groups of investigators were in agreement with Kalinowsky as to the distinct advantages of the electrical method over the earlier pharmacological convulsion technique. Towards the end of the year 1940, electric convulsion therapy came into appreciable use in various hospitals and clinics in Britain. By then interest had been well aroused in the application of convulsion therapy to the depressive psychoses, and most of those adopting the electric method did not hesitate to apply it as freely to such cases as they did to cases of schizophrenia. The author was fortunate in obtaining an electrical apparatus in October, 1940, and since then has applied it to some 140 cases of schizophrenia and to about 280 cases representing other forms of psychosis, the greater part being depressive states.

The literature at present contains but few statistics on the application of convulsion therapy in psychoses other than those of the schizophrenic type, despite the now fairly general agreement that manic-depressive states and involutional melancholia present the most favourable material. It is thus hoped that this paper, which devotes attention mainly to the treatment of depressive states, may serve as a small contribution towards the present need for statistics.

Comparison with Cardiazol Therapy.

For the purpose of comparison with the results of electric convulsions, the following summary has been compiled of the hitherto published results of those using pharmacological shock methods (Fig. 1):

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FIG. 1.

Authors.	Type of psychosis.	Number of cases.	Recovered or greatly improved.	Improved.	Slightly improved or not improved.
Steinberg and Nierenberg (7)	Involutional	11	2	7	2 (?)
	Man.-dep.	(50)	(?)	(?)	(?)
von Meduna and Friedman (8)	"Chiefly affective psychoses"	109	80	—	29
Wilson (9)	Involutional	19	14	1	4
	Man.-dep.	11	5	—	6
Bennett (10)	Depressed	37	19	18	—
	Involutional	24	11	12	1
Corwin and Voth (11)	Depressed	49	25	21	3
Palmer, Hastings and Sherman (12)	Involutional	27	10	9	8
Cheney, Hamilton and Heaver (13)	Involutional	16	10	5	1
	Man.-dep.	51	26	22	3
Zeifert (14)	Involutional	4	4	—	1
	Man.-dep.	19	18	—	1 (?)
		377	224 (59 per cent.)	95 (25 per cent.)	59

The average pharmacological-shock remission rate of 59 per cent. is very favourable, but the main advantage of the electrical over the pharmacological method lies in the fact that it is accompanied by less unpleasant subjective sensations, and is consequently more readily accepted by the majority of patients. A recent article by Kolb and Vogel (15) illustrates the rapid rise in popularity of the electric method. On addressing enquiries to 305 American hospitals they found that, of 111 using all three forms of shock therapy (electric, cardiazol and insulin), almost 60 per cent. showed a preference for the electric method, and only 8 per cent. preferred the pharmacological method of inducing convulsions.

SELECTION OF CASES.

The selected series of cases were all of the manic-depressive or involutional types of depression. All of them were frankly psychotic and showed characteristically melancholic symptoms, such as severe depression, retardation and agitation. Many were mute and apathetic, and most of those capable of describing their subjective symptoms expressed delusions of guilt. Care was taken to exclude non-delusional cases of depression which could not with certainty be regarded as falling within the psychotic, as distinct from the neurotic, group of depressive states. It will be noted (Fig. 1) that most of those describing the results of cardiazol therapy preferred to group the involutional and manic-depressive psychoses separately. Opinions differ, however, as to the differential diagnosis of these two forms of psychosis, and since in the great majority of the cases to be described the illness occurred within the involutional period of life, the writer considered that little, if any, prognostic value might accrue from making such a differentiation. An impression has been gained, however, that a study of the pre-psychotic personality of these cases of depression would yield statistics of prognostic value. It has been noted that, on the whole, cases in which the pre-psychotic personality showed "melancholic" traits responded more favourably to convulsion therapy than those in which the pre-psychotic personality exhibited "manic" features. A rather similar impression in this respect was obtained by Palmer, Hastings and Sherman (12) when treating cases of involutional melancholia by metrazol-induced convulsions. It is probable that, other factors such as duration of illness being equal, the depressive states should be grouped in the following prognostic order of favourability for treatment:

(1) Melancholics in whom the pre-psychotic personality showed "melancholic" trends.

(2) Melancholics whose pre-psychotic personality showed no "melancholic" features.

(3) States of mania.

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FIG. 2.

Age on treatment.	Sex.	18/20.	20/25.	25/30.	30/35.	35/40.	40/45.	45/50.	50/55.	55/60.	60/65.	65/70.	Total.	
Discharged recovered	F.	—	1	4	3	7	8	11	12	13	8	2	69	78·0%
	M.	1	—	1	5	4	4	8	10	5	7	3	48	
Discharged improved	F.	—	—	—	—	—	1	3	1	—	—	—	5	4·0%
	M.	—	—	—	—	—	—	1	—	—	—	—	1	
In hospital improved	F.	—	—	—	—	—	1	3	1	—	1	—	6	5·3%
	M.	—	—	—	—	—	1	—	—	1	—	—	2	
In hospital unchanged	F.	—	—	—	—	—	—	1	1	—	2	—	4	4·6%
	M.	—	—	—	—	—	1	—	—	2	—	—	3	
Discharged recovered, but relapsed	F.	—	—	—	—	—	1	3	1	1	1	1	8	8·0%
	M.	—	—	1	—	1	—	1	1	—	—	—	4	
Total treated													150	

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With regard to mania the writer has never encountered a case in which the pre-psychotic personality failed to show " manic " features, such as speed of thought and action, wide range of interests, determination and emotional lability.

Attention is being devoted to this prognostic point for future assessment, but unfortunately the case-histories of the present series of patients did not give sufficient data on pre-psychotic personality to illustrate any worth-while figures in support of the hypothesis.

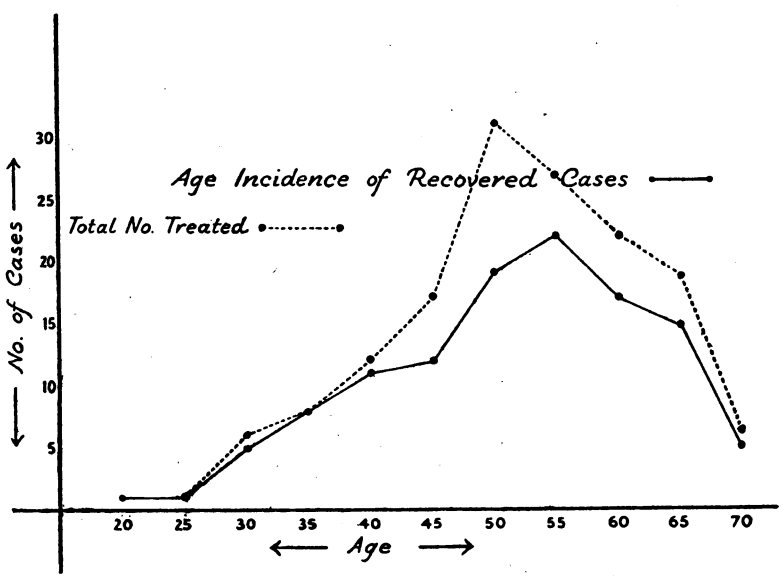
Observations on Treatment.

A total of 92 female and 58 male cases of psychotic depression were treated during the period November, 1940, to October, 1942. Their ages ranged from 18 to 69 years, but the majority were over the age of 45. The apparatus used was that described by Fleming, Golla and Grey Walter (5). Fig. 2 illustrates the results of treatment in relation to the age of patients at the time of commencing treatment.

The term " recovered " was applied to those who, on discharge from hospital, were fit to resume normal occupation. The term " improved " was applied where patients were not fit to take their normal place in extra-mural life, but had nevertheless shown a sustained partial remission of symptoms. Of those listed as improved on discharge from hospital some have since resumed their normal responsibilities, and had they remained in hospital for longer periods of convalescence, might have been regarded as recovered. Any patients in whom the remission of symptoms proved to be of a temporary nature have been included with those regarded as unchanged by the treatment. All those who relapsed and were again admitted to the same hospital or to other hospitals are placed in a separate group. The group marked recovered thus only relates to those patients who, at the time of writing, have apparently remained fully rehabilitated to their normal environment.

Fig. 3 illustrates the age-incidence of patients who fully recovered under treatment.

Fig. 3.



Various text-books of psychiatry, e.g. Bumke (16), Sadler (17), Strecker and Ebaugh (18), Ewen (19), mention a spontaneous recovery rate of 20–40 per cent. for involutional melancholia. About 70 per cent. of the author's cases were over the age of 40 and might be regarded as having entered the involutional period of life. Making allowance for non-involutional cases, the recovery-rate of 78·0 per cent. following electric convulsion therapy thus would still appear considerably

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more favourable than the spontaneous recovery rate. Furthermore, it is generally accepted that in regard to cases of psychotic depression over the age of 40 a hospitalization period of 6–9 months is usual for spontaneous recovery, whereas in the present series of cases about a third of that time was sufficient.

Fig. 4 gives some of the hitherto published results of others dealing with the same subject:

FIG. 4.

Authors.	Form of psychosis.	Recovered.	Improved.	Not improved.	Total.
Furst (20)	Man.-dep.	6	14	7	27
	Involutional	16	9	3	28
Gonda (21)	Depressive	7	—	1 (?)	8
	Involutional	3	—	—	3
Hemphill and Grey	Depressive	5	—	—	5
Walter (22)	Involutional	5	1	1	7
Total		42	24	12	78

FIG. 5.

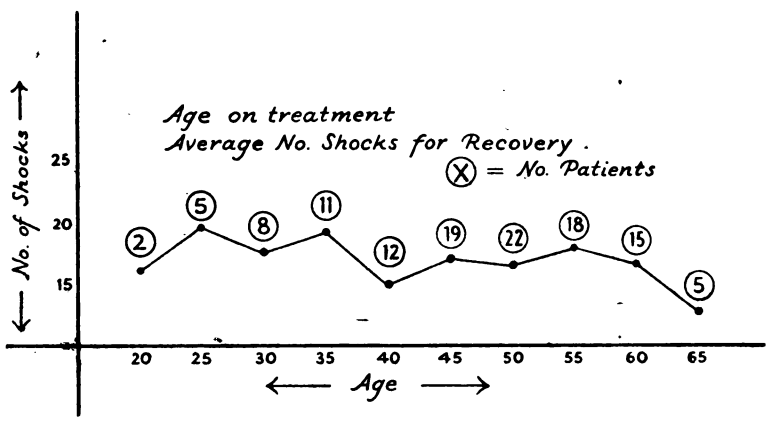
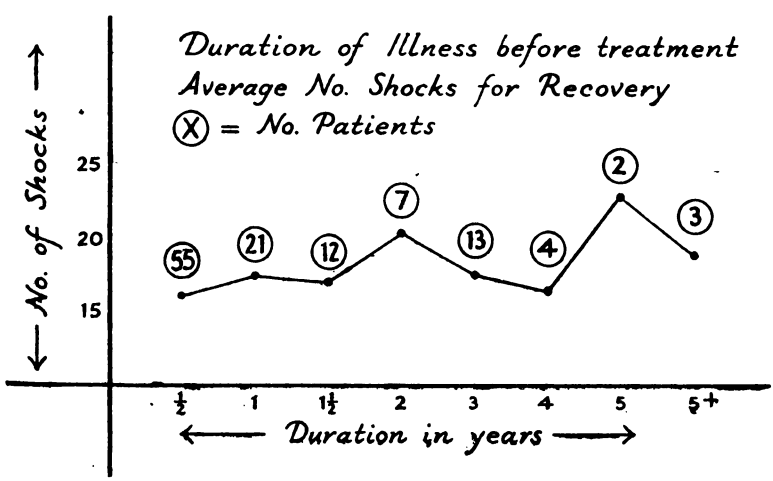


FIG. 6.



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The low number of full remissions noted by Furst (20) may be attributed to the fact that he did not regard any case as having attained full remission which had not also full insight. Many of the cases whom he regarded as being merely improved would no doubt have been regarded as full remissions by other psychiatrists. To use the degree of insight as a standard of recovery is a system which does not readily lend itself to convulsion therapy. Many patients on reaching a level of improvement which renders them fit to return to normal employment may nevertheless have considerable amnesia for the earlier phase of their illness, and what appears to be lack of insight concerning their former symptoms may in fact be lack of recollection of them. Furst also mentions that he found five or six convulsions to suffice in treating cases of manic-depressive psychosis. This view is at variance with that of the present writer, who found that, quite irrespective of the age of patients, and of the duration of illness, the average number of convulsions required for sustained remission of symptoms was approximately 17 per patient. This latter point is illustrated in Figs. 5 and 6.

The maximum number of convulsions required for sustained remission in any case was 33, and the minimum 4, but only seven patients required less than 10 convulsions.

The duration of illness prior to treatment is undoubtedly of less importance in the selection of cases of the melancholic types for treatment than it is in regard to cases of schizophrenia. Fig. 7 illustrates the recoverability of patients in relation to the duration of illness:

FIG. 7.

Duration of illness before treatment.	Months.		Years.					
	0/6.	6/12.	1/1½.	1½/2.	2/3.	3/4.	4/5.	Over 5.
Average ages Male	45	43	61	53	55	56	—	50
Average ages Female	44	48	57	45	52	57	55	49
Recovered	55	21	12	7	13	4	2	3
Improved	1	5	1	1	2	2	—	2
Unchanged	—	—	2	—	1	4	—	—
Recovered and later relapsed	5	2	—	1	1	1	1	1

It will be noted that the duration of illness does not materially affect the prognosis providing that it does not exceed three years.

TECHNIQUE.

Convulsions were administered to each patient every second day until the more acute symptoms of depression and retardation had subsided. This was usually found to occur after the tenth convulsion. The patient was then given a rest from treatment for a few days. If the symptoms reappeared a further short course, usually of not more than six to eight convulsions, was administered. Some patients even after 15 shocks continued to slip back, and these were usually given a weekly maintenance shock. The appearance of prolonged confusion was considered to be a contra-indication to further treatment. Such confusion lasting more than 12 hours after a particular convulsion was rarely seen to arise during a course of less than ten shocks. However, the occurrence of confusion during a course of treatment did not appear to delay recovery. It was generally met with in cases where the illness was of several years' duration. Many of the more chronic types were mute and apathetic, and it is possible that their apathy masked some residual dementia, which only manifested itself when they improved to the point of being able to converse. Many patients became extremely agitated and restless at about the fourth to sixth treatment, and frequently delusions and auditory hallucinations became more prominent in this phase. The following two or three shocks often produced a striking return to normality. Having noted that sustained improvement is exceptional as a result of a course of less than 10 shocks, one might consider giving the first 7 to 8 shocks at daily intervals with the object of getting the patient past the restless and agitated phase as quickly as possible. This practice would, however, appear to be not altogether desirable by reason of the fact that it would frequently hinder the operator from distinguishing between the transient

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confusion which normally persists for some hours after a convulsion, and the more sustained confusion which is regarded as a contra-indication to treatment, and which may possibly be secondary to some physical brain damage. The writer is in agreement with A. E. Bennett (10) and the many others who advocate giving convulsion therapy only to hospital in-patients. The tendency nowadays to give convulsion therapy to out-patients at the rate of one shock per week per patient is deplored, and it is feared that such technique will bring convulsion therapy into disrepute. Any form of out-patient convulsion therapy is unsatisfactory by comparison with in-patient therapy. The only advantage which can be claimed for the out-patient treatment is that it avoids the necessity of admitting a patient to hospital. This advantage is very much belittled by comparison with the following advantages of in-patient treatment:

(1) The patient receives continual assurance and attention from the nursing staff, which is especially comforting in the early stage of treatment when the temporary amnesia may be distressing to the patient.

(2) The patient's behaviour between treatments is observed and accurately reported by trained nurses, whereas in the out-patients' department one has to rely on the often misleading accounts of relatives.

(3) The patient is adequately protected in the event of his suffering a sudden outburst of violence. This is by no means an infrequent occurrence in treating cases of schizophrenia, and it is not easily anticipated. Similarly, in treating types of endogenous depression sudden suicidal impulses may occur during any phase of the treatment.

(4) The patient receives generally a more condensed course of treatment, and is consequently able to resume his normal mode of life at an earlier period.

(5) Many users of convulsion therapy advocate supplementing it with some, at least, superficial psycho-therapy. In this respect the in-patient is again usually in a more favourable position.

(6) More time is usually available to study the patient's domestic environment through the medium of a psychiatric social worker, and circumstances conducive to the patient's relapse may be smoothed out or avoided.

(7) Complications, such as fractures, and the lighting-up of old tuberculous lesions, are less likely to be overlooked.

Social Worker's Follow-up.

Miss D. Tamplin, the social worker of Shenley Hospital, addressed inquiries to the relatives of all patients who had left hospital. These inquiries were sent at the expiration of six months from the time of the patient's discharge, and again at the expiration of twelve months. Where the reply indicated that the patient was normally employed, and was considered normal from the social standpoint, the result was listed as "satisfactory." Where the patient was not normally employed or was regarded as abnormal by the social standards, but nevertheless fit to be cared for in home surroundings, the result was classified as "fair." A record was also kept of those who relapsed and were admitted to the same or to other hospitals. A few could not be traced, or else failed to reply to repeated inquiries.

This system of follow-up yielded the following results:

Satisfactory after 12 months	33
Satisfactory after 6 months	30
Fair after 12 months	2
Fair after 6 months	3
Satisfactory at 6 months, but no reply at 12 months	3
Relapsed and readmitted	9
No reply to repeated inquiries	5
Total	85

It is the social worker's intention to continue to communicate with these patients at yearly intervals. Many of them formerly suffered from recurrent attacks of depression, and it is hoped that in the course of time some evidence will be obtained as to whether convulsion therapy has been influential in checking such recurrences.

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SUMMARY.

(1) The development of electric convulsion therapy is discussed in relation to its application to states of so-called endogenous psychotic depression.

(2) Results obtained by some of those who have treated similar cases by pharmacological convulsion methods are summarized for the sake of comparison.

(3) The hypothesis is offered that grouping cases of depression according to their pre-psychotic personality will yield more valuable prognostic criteria than the more usual system of drawing distinction between the involutional cases and the manic and melancholic phases of manic-depressive psychosis.

(4) A total of 92 female and 58 male cases of psychotic depression were treated during the period November, 1940, to October, 1942. Of these, 117 (78 per cent.) were discharged recovered and continue to remain in home surroundings. Six (4·0 per cent.) were discharged improved, 15 (10 per cent.) remain in hospital, and 12 (8 per cent.) were discharged but later relapsed and were readmitted to hospital.

(5) The number of convulsions required for sustained remission of symptoms has been found to average 17, irrespective of the ages of patients at the time of treatment, and of the duration of their illness.

(6) The recoverability of patients was found to be unaffected by duration of illness providing that it did not exceed three years.

(7) A social workers' follow-up of the cases discharged from hospital shows that of 85 patients who have been in home surroundings for more than six months 63 are known to be normal and usefully employed, only 5 of those remaining at home have failed to maintain normality by ordinary social standards, 9 have had to be readmitted to hospital, and the end-result of 8 could not be determined. Less than six months have elapsed since the remaining 32 " recoveries " left hospital, and they therefore have not been followed up, but it is known that of these three have already relapsed.

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SOME COMPLICATIONS ARISING DURING ELECTRICAL CONVULSIVE THERAPY.

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[Received November 18, 1942.]

In 1938 Wespi (1) in Germany and Stalker (2) in this country reported cases of crush fracture of the spine following cardiazol convulsion therapy. It was not until then, some four years after its introduction, that attention was focused on the risk of fracture in this form of therapy. During 1939 alarming reports appeared, especially in the United States, regarding the occurrence of such mechanical injury. Polatin *et al.* (3) radiographed 51 cases following metrazol convulsive therapy and reported spinal fractures in 43 per cent. Bennett and Fitzpatrick (4) in a similarly treated series of cases recorded 47 per cent. spinal fractures. However, the latter figure was obtained from a series of only 18 cases, and should therefore be accepted with reserve. In this country H. A. Palmer (5) in a series of 20 cases treated by cardiazol shock therapy found spinal fractures in no less than 5 cases (25 per cent.).

In view of these publications the method fell into some disrepute, despite von Meduna and Friedman's (6) reputed series of 3,000 cases of mental diseases treated by shock therapy, of which only 1·1 per cent. showed mechanical injury. Kolb and Vogel (7) have given the figure of 9 per 1,000 for the incidence of mechanical injuries following electrical shock therapy. Kalinowsky (8) stated that Cerletti and Bini, the originators of this form of shock therapy, " had produced several thousand fits in some hundred patients without any accident whatever."

During the present investigation it has been the practice, on the grounds of economy, only to radiograph patients who showed symptoms or signs during the course of treatment. Of 420 patients who were treated by electrical convulsion therapy, 12 (2·8 per cent.) showed bony injury. As all patients were not radiographed after treatment it is likely that the figure of 2·8 per cent. is too low.

It would appear that despite the somewhat conflicting figures given for the incidence of fractures in metrazol therapy there is *less* risk of fracture after electrical shock.

Material Investigated.

In the present series 12 (2·8 per cent.) cases of fracture were noted in 420 consecutive cases treated by electrical shock therapy.

Sites of Fracture.

Table I shows the distribution of the sites of fractures. Whilst the spine is the commonest site, fractures appearing in the extremities are not uncommon, and have a far more dramatic immediate result than spinal injuries.

Table I.

	Cases.
Spines	5
Fracture dislocation of humerus	2
Simple fracture right humerus	1
Femoral neck	5
Pelvis	1

The difference in the total number of fractures to the number of cases is accounted for by the fact that two cases showed multiple fractures.

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Considerable displacement was present in all the fractures of the extremities. In the fractures of the humerus, which were all at the surgical neck, two cases were associated with posterior dislocation of the humeral head which remained on the posterior lip of the glenoid cavity. Possibly hyperextension of the arm during convulsion accounted for the unusual displacement in these fracture dislocations. Folding the arms across the chest may help to lessen the likelihood of this injury.

Five fractures of the femoral neck occurred and the site of fracture varied from an intra-capsular to an extra-capsular type. In one case a fracture of the neck of both femora occurred. In another case a fracture of the other femoral neck occurred after one hip had been placed in a plaster spica. It is possible that the restraint imposed by a Whitman's spica so altered the mechanics of the pelvis that fracture of the femoral neck on the other side occurred more readily.

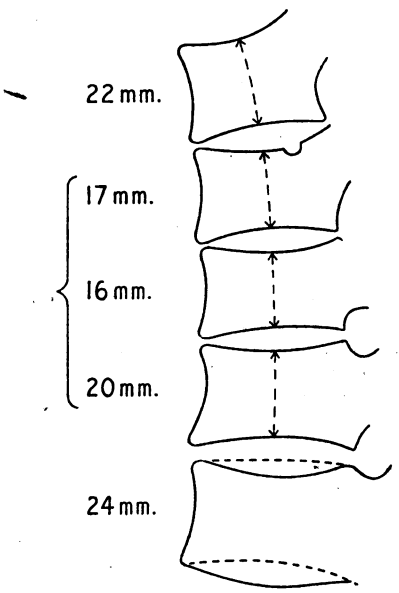

FIG. 1.—Tracing from a radiograph of the upper dorsal spine showing the rounded kyphus and the minor degree of compression of several of the vertebral borders. Note that the narrowing appears to be greatest at the mid-part of the body and not in the anterior part. With further treatment complete collapse might have appeared.

One of the cases showed a traumatic intra-pelvic protrusion of the femoral head. A moderate protrusion of the femoral head was present. This unusual complication has been previously described after cardiazol therapy by Meduna and Friedman.

Five cases of fracture of vertebral bodies were seen, and in two cases more than one vertebral body was affected. The commonest site for vertebral fractures to occur is the upper dorsal spine, and in this respect vertebral fractures following electrical convulsion therapy are similar to those following cardiazol therapy.

The recognition of these fractures requires careful examination of the radiographs. Radiographs showing good detail of this part are difficult to obtain, especially so in non-co-operative patients. By not suspending respiration during the exposure and by using a high k.v. and millamperage with a short exposure time satisfactory radiographs can be obtained. The antero-posterior view is not of as much value as the lateral view. In some cases inspection of the radiographs will show a typical crush fracture; in others (Fig. 1) careful measurement of the depth of the vertebral bodies is necessary to detect these fractures. In many cases a round kyphus of the upper dorsal spine will be seen to be composed of small degrees of compression fractures of several adjacent vertebral bodies (Fig. 1).

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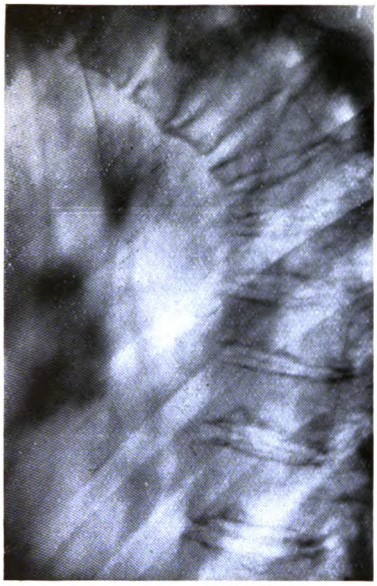


FIG. 2.

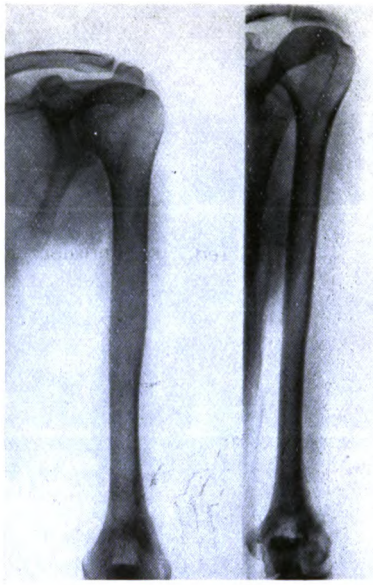
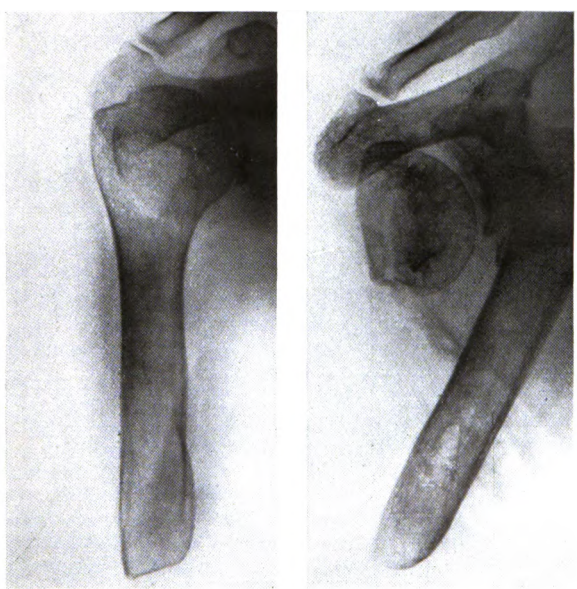


FIG. 3.

FIG. 2.—Patient, aged 41. *Grand mal* for 21 years. One major fit per day. The 3rd to the 9th dorsal vertebrae show crush fractures with varying degree of collapse of the vertebral bodies. Traumatic Schmorl's nodes are present in lower dorsal vertebrae and osteo-arthritic changes are present.

FIG. 3.—Showing decalcification. The right humerus of a patient with a control film of another mental patient. The shaft shows general decalcification, widening of the medullary canal and loss of the cortical bone. These changes are most marked at the surgical neck.



(*a*) (*b*)

FIG. 4 (*a* and *b*).—(*a*) Shows an amputation stump of a patient submitted to electrical convulsion therapy. The decalcification of the bone is extreme. (*b*) After treatment showing a fracture of the surgical neck of the humerus.

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Palmer has classified vertebral fractures into three groups, depending on the severity of the injury :

Type I : Fracture of anterior tip of vertebral body.

Type II : Minor degree of compression of vertebral body with striae along lines of compression.

Type III : Complete collapse of the vertebral body.

No case belonging to the first type was met with in this series, but cases showing instances of type II and type III were noted. This subdivision appears to be somewhat artificial, as both type II and type III may be met with in any single case.

In the author's series the original injury appeared to be in the mid part of the body beneath the widest part of the intervertebral disc (Fig. 2). This fact, coupled with the tendency of vertebral fractures to occur after three or four shocks, rather than with the original shock, suggests that herniation of a portion of the disc into the vertebral body may be the primary cause of the collapse. Certainly it is difficult to follow the argument (3, 4) that hyperflexion is the cause of these injuries. If hyperflexion with a jack knife effect is the main cause, it is hard to see why the upper dorsal region, the most immobile part of the spine, should be chosen as the commonest site for fracture.

In all the cases of vertebral fractures reported in this series, symptoms such as backache were complained of and none was symptomless. It has been suggested (9) that these fractures are of no importance, and certainly their appearance is far less dramatic than fractures of the extremities. Osteo-arthritis must, however, occur as a delayed sequel, and it is possible that the pain induced by these changes may hasten a late relapse in the mental condition. A result of numerous fits over a period of time is illustrated in Fig. 2. This patient was an epileptic who had several *grand mal* attacks each week for many years, showed at the age of 41 marked spinal osteoarthritic changes and multiple fractures.

One case of a crush fracture of a vertebral body from previous cardiazol convulsion therapy was able to undergo a further course of electrical therapy without any further spinal damage.

Three cases of dislocation of the jaw were noted, but in each case even casual examination revealed the injury and reduction was quickly effected.

Use of Radiographs before Treatment.

Amputation stumps.

Amputation stumps were noted to be especially liable to fracture. This may be the result of disuse atrophy and altered muscle mechanics. The responsible person in these cases should be warned of the added risk. Fixing the amputation stump does not appear to be effective in preventing fracture; in fact fixation, like any form of mechanical restraint, appears to enhance the risk of fracture.

Any case which was judged clinically to be undersized was submitted to pre-therapy radiographs to estimate the degree of decalcification. A patient of the same age, sex and stature was used as a control. The patients' limbs were radiographed, and correspondingly the control limits on the same film, both being given the same exposure. It was not found to be practical to place the patient's limb and the control's limb on the film at the same time and thus give the exact degree of radiation to both. It was, however, possible to give an almost identical exposure to the control and thus obtain films which were comparable (Fig. 3).

Sites at which fractures commonly occur, such as the surgical neck of the humerus, were especially carefully scrutinized, and experience showed that a fair prognostication of the risk of fracture could be made. It is not possible to give a dogmatic opinion, and for this reason and on the grounds of economy the method was not used in all cases. Only those patients whose clinical examination suggested the possibility of decalcified bones were submitted to radiography.

The risk of fracture is proportionate to the degree of decalcification. Evans (10) first noted this fact in a case having generalized osteoporosis.

Steiner suggested that this decalcification was due in many cases to a starvation osteomalacia, but in a considerable number of melancholics lack of muscular tone, accompanying the apathetic mental state, must contribute to the atrophy of the skeleton. The continued muscular inactivity of these patients also contributes to

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the atrophy of the skeleton. A comparable finding is the atrophy of bone noted in an amputation stump, a factor which has already been mentioned (Fig. 4).

Osteo-arthritic changes.

Originally it was thought that osteo-arthritic changes in the spine might predispose to fractures with electrical convulsion therapy. In the present series it was found that osteo-arthritis, unless associated with senile decalcification, did not predispose to fracture. Many of these patients, however, complained of backache after convulsion therapy, presumably due to damage to the ligamentous structures. Osteo-arthritic changes in large joints did not materially add to the risk of fracture.

Cardiovascular system.

Teleradiographs of all chests clinically suspected of showing cardiac disease were taken. Screen examination was also carried out. Careful attention was paid to the shadows of the great vessels, widening and uncoiling of the aortic arch being noted.

Enlargement of the heart was considered to be a contra-indication to electrical convulsion therapy. Further work is necessary to clarify the types of cardiac conditions which are unsuitable for electrical convulsion therapy.

Respiratory system.

Pre-therapy teleradiographs of the chest were taken on all patients who complained of cough, or when any clinical signs of respiratory disease were noted.

Two cases of healed pulmonary tuberculosis were treated with no undue effects, but another case showed active pulmonary tuberculosis, and it is possible that treatment may have activated this condition. It is considered that cases showing fibrotic tuberculous foci, even if they appear quiescent, should only be treated if reasonable hope of cure by this method can be entertained.

Conclusions.

(1) In 420 cases treated by electro-convulsion method 12 cases (2·8 per cent.) showed fractures. This figure may be unduly conservative, as routine post-therapy radiographs were not employed.

(2) Demonstration of spinal fractures requires films of high technical detail.

(3) A discussion of the mechanism of spinal fractures is included.

(4) Examples of fractures occurring in the limbs are described.

(5) The use of radiographs before commencing therapy to estimate the risk of fracture is described.

(6) The use of pre-therapy radiographs of the respiratory and cardiovascular system in relation to treatment is described.

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SUICIDAL HEAD INJURIES.*

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DAMAGE to the frontal lobe is liable to produce personality changes; it is highly probable that lesions have to be bilateral to have this effect. But beyond that, there is little agreement about type, extent and localization within the frontal lobe of the lesions which are followed by personality change. Little is known about the different types of clinical picture caused by bilateral frontal lesions. In a certain proportion of the cases euphoria is the most impressive symptom, and it is for this reason that operations on the frontal lobes have been proposed in the treatment of depressions. (*Lit.*, see Hutton.) The value of the procedure is still under discussion, and its theoretical foundation is far from being understood. This is not surprising, for if one tries to analyse such an operation, one has to take into account at least four variables: the patient's previous personality, his mental illness, the psycho-physiological effect of the lesion, and the psychological effect of operation, nursing care and environmental changes. The cerebral factor is obviously the most interesting one; to judge its importance one tends to interpret the operative results in the light of experience after other frontal operations or injuries.

It is evident that the effect of frontal lobe damage on a depressed patient need not be the same as on a normal personality. It was therefore thought of some interest to study the effect of cerebral injury in depressed patients with self-inflicted cerebral damage. There are other difficulties in the interpretation of the results in these cases which will be discussed at the end of the case histories. By comparing and contrasting clinical conditions in which some factors are constant while others vary, one gets a composite picture as a substitute for the experimental methods in which one is able to control all factors at will.

The following case histories will show—

1. That some patients with suicidal cerebral injuries show a dramatic change in their mental states.

2. That this damage is relatively independent of the localization of the cerebral damage.

3. That therefore other factors than the local injury must be sought to account for the change in the mental state.

CASE 1.—Man, aged 36, intelligent and well adjusted. Endogenous depression of three or four months' duration. Suicidal gunshot wound. Injury to both frontal lobes. Recovery from depression; slight loss of initiative.

Sgt. G. T—, R.A.F., aged 36, was transferred to a Military Hospital (Head Injuries) on 27.vi.41. He had shot himself with a revolver on 8.v.41 and was admitted to the nearest hospital, where he was treated until his physical recovery. During the initial delirious state he reproached himself of having taken money. On arrival here he showed a large bony defect in the left frontal region, and another one to the right of the midline. He had no neurological signs. He gave the following history: A sister committed suicide when she was 42. The exact reason is unknown; it was thought "the blackout got her down." Patient himself was an average scholar; he reached top standard at school. On leaving school he became a clerk. He had two clerical jobs in 13 years. He then started a wireless business with a partner, but gave it

* Report on work carried out with the help of the Rockefeller Foundation.

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up after two years. In 1937 he joined the R.A.F. (clerical duties) and felt perfectly happy in his job. He had been working very hard since the outbreak of the war and had had no leave since December, 1939. For the last three or four months he had been feeling rather depressed and found that little things worried him. He thought he needed a holiday, but there were so many changes in the office that he did not see how he could possibly get leave.

Although he had been depressed for some months he had not contemplated suicide. He had a revolver in his custody which belonged to another man, and he had had it for some days when one afternoon he felt so depressed that he thought he would finish things off. He did not write a farewell letter; there was no chance of his being prevented.

Domestic background: He was married eight years ago. There is one child of seven. He separated from his wife four years ago and is giving her a voluntary allowance. There were no specific troubles, no acute break. They hit it off well at first, but he got irritable with his wife's relations. He has no financial worries.

He describes himself as a "happy-go-lucky" fellow who did not bother about the future. He was never ambitious, perfectly content when he had his living. He never worried much and soon got over the break with his wife. He was always a good mixer, fond of company, and had many friends. He had never had any depression or hypomanic phase before, and no phases of insomnia or anything that could be interpreted as manic-depressive equivalents.

On examination he was quite cheerful (though his sister reported that he was very dejected at times; he explained that it was because he was not allowed into town with the other patients). He spoke little, unless he was asked, but he was in good contact with other patients. When talking about his depression he tried to make light of it. He denied being depressed now. He was rational and critical, he had no demonstrable defect of memory or concentration, and his behaviour during two months' observation was unexceptionable. He was boarded out soon after.

Follow-up, August, 1942: After his discharge he went to live with his mother. He registered with the Labour Exchange, but has not been employed yet. He attends no doctor and has no complaints. But his mother says his temper is very uncertain and there are times when she hardly dares speak to him. On the other hand, she says that to anyone else he behaves cheerfully and normally. He goes out very little and mostly sits at home reading.

His mother also gave this additional information. She was happily married and does not seem to have had any previous mental illness. She became depressed soon after she and her husband had moved to a new bungalow away from the place where they had spent all their married life. She visited her mother one afternoon, and suddenly made an excuse to go out at the back and disappeared. She was found later in the sea.

The patient himself was a "wonderful boy" and was much spoilt by his mother and sister. He married young and hastily against the mother's advice. His wife was always running to her mother and constantly found fault with him. Finally she went to her mother and patient joined the R.A.F.

It was at the time of his return to his unit that his sister died. He had had no leave for a long time and then had difficulty in getting it for his sister's funeral. This upset him a lot and he overstayed his leave.

CASE 2.—Man, aged 40, intelligent and syntonic. Endogenous depression, aggravated by circumstances, of more than three months' duration. Suicidal gunshot wound through left temporal lobe. Recovery from depression with residual monoparesis and aphasia; no noticeable deterioration of intelligence or character.

Major J. W—, aged 40, was admitted to the Military Hospital (Head Injuries) on 15.xi.41. He made a suicidal attempt on 16.ix.41. He gave the following history: His father died from heart disease. A brother suffered from nervous attacks as a result of having been blown up in the last war. Patient himself went to a secondary school until he was 15. He went into his father's motor business on leaving school and has been in the same business ever since. He joined the Army in January, 1940, having been in the Territorials before. He had to work very hard; he lost 6 st. in weight. The work got on top of him. He had only three days' leave. He felt he was not doing as well as he should, although he did not think other people noticed it, as he was promoted Major. But he became increasingly tired, fed up, and depressed. He was very upset by an incident in July, 1941, when he was criticized for not having finished a report on which he had been working till late the night before. He admitted he might have been slower in his work than usual and it cost him an extra effort. Though he felt the criticism was unjust he was very upset by it and he kept on "telling himself off" ever since. He became different, kept on asking himself whether he had done his work correctly and wasted a lot of time checking and re-checking. He spoke to nobody about his troubles, but he became more and more worried. He had no recollection of any incident that might have driven him to attempt suicide. He had a long ill-defined amnesia for some time before his suicidal attempt, and a post-traumatic amnesia of about three weeks.

On examination he had a slight weakness of the right upper limb and a left-sided nerve deafness. The scar of the entry wound was at the junction of the soft and hard palate, just to the left of the midline; the exit wound in the left parietal bone. X-rays showed a comminuted fracture of the left parietal bone and a track through the petrous bone, with numerous splinters marking the course of the bullet. The EEG was normal.

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He had a considerable logorrhoea; his spontaneous speech contained numerous paraphasic words and syntactical errors. He had great difficulty in finding nouns, but he showed great ability in circumlocution and expression by mime and gesture. He had great difficulty in grasping the meaning of short requests, questions and reasoning problems. Writing and reading were secondarily involved. He did well in a non-verbal intelligence test (Raven matrices 46/60). His learning curve (non-verbal material) was only slightly delayed. He was quite cheerful, and tried very hard to improve his speech. He was very pleased with himself when he succeeded in saying something after much difficulty. There were not the slightest signs of depression at any time during seven weeks' observation. He was willing to believe that his injury was due to a suicidal attempt, though he felt it was quite unlike him to do such a thing. He was discharged home on 10.i.42.

History from his sister: Father was a master motor engineer in the very early days of cars. He died, aged 62, of cerebral haemorrhage. He was very generous and a very conscientious worker and patient is said to be very like him. Mother died aged 64 of an inoperable tumour. There were 12 brothers and sisters. They were an exceptionally united family and there is said to be no nervous illness.

Patient left school at 15 and became a clerk in his father's motor business. He was very conscientious and hard working, and by 1940, when he enlisted, he had become store manager of one of the largest garages in Hull. His health was always very good—a real specimen of manhood. He weighed 17 st. 9 lb. when he joined the army.

Previous personality: he was generous, good tempered, gentle; he would not hurt a fly. He was easily hurt and always apt to worry over trifles, especially about work. He never showed any inclination to get married, and seemed happy living with his parents and later with informant. He had many friends. He was a keen sportsman and a Freemason. He drank mildly, but was a heavy smoker.

Follow up, 2.iv.42: On arrival home he seemed tired, and his speech was poor; he began to improve, but when he was told that he was to be discharged from the Army and he would not be entitled to receive a pension he was very upset, and three days later he had an epileptic fit, with twitching mainly of the right side of his body. Since then he has made a slow but steady improvement again; he is up and about and does a bit of light carpentering about the house. He still hesitates about words and he worries about his speech and about his health in general. But this seems to be within normal limits, and there is nothing to indicate his being depressed now.

CASE 3.—Man, aged 26, intelligent, slightly psychopathic, but well adjusted. Acute reactive depression of short duration. Suicidal gunshot wound through both frontal lobes. Recovery from depression with residual monoparesis. Slight and transient lack of initiative.

L.-Cpl. W. W. H—, aged 26, was admitted to the Military Hospital on 3.vi.41. He had attempted suicide on 1.v.41. On admission he said he had felt depressed and fed up for a week before his attempt because he had been told by his C.S.M. that he was not pulling his weight. He denied all other causes for his depression, which had only been present for a week or two; there had been no headaches or insomnia or any other symptoms before. One Saturday morning he decided to do away with himself. He took a .45 revolver and pointed the barrel to his temple. What happened after that he did not know. He was certain he did not shoot himself although he heard the revolver go off. He had an amnesia for the subsequent eight days. The notes of the hospital where he was treated first said that he was conscious and lucid on admission, but complained of headache. His family history was negative.

Personal history: he had a stutter from early childhood, varying in intensity but never as bad as it was now. He was always rather conscious of it, and became shy and sensitive, but always tried to overcome that. He was keen on all outdoor sports; he played rugger, cricket and water polo. He joined the Territorials three years before the outbreak of war. He lived always in his father's house, looked after by his mother and employed by his father. He did clerical work and was paid £2 15s. in addition to his keep.

Physical examination: Right lower facial weakness; spastic monoparesis of right upper extremity. Scar of entry wound in right lower frontal region; exit in left upper frontal region. X-rays showed corresponding bone defects. There was a small bony fragment carried into the entry wound. An air encephalogram showed a slight enlargement of the left anterior horn; no displacement of the ventricular system. The EEG was of low voltage, and there were low voltage 2–3 per second waves in the posterior part of both hemispheres.

Mental state: left to himself he used to lie in bed quietly. He read sometimes, but tended to do nothing. He did not appear to be depressed, nor did he laugh or smile spontaneously. He said he felt quite happy again and had no intention of repeating the attempt on his life. He firmly denied ever having been depressed before, but he had felt overworked for months on end, and for a fortnight before his attempt he had felt depressed about the conditions at his unit. One or two days before the incident he had a particularly bitter experience, being blamed for not sending in a report which was not his responsibility. He did responsible office work all the time, and it was only on account of his stutter that he was not promoted. He feels now mentally his previous self, in fact better than he felt before his suicidal attempt.

During the interview he was perfectly coherent and logical in what he said and he made an

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intelligent impression. He explained his mental balance by his new faith in religion and God; he owed this to the influence and help of an officer of his unit, who, after the accident, came to see him and corresponds with him regularly. He was never religious before, although he was brought up in the usual way, going to Church on Sundays and so forth. He would not mind going back to his unit; he did not think he would feel self-conscious; not many people in the unit would know what had happened, and those who did would be nice and sympathetic.

There was no demonstrable disturbance of his mnestic functions. He was quick, but rather erratic and fatigable in a cancellation test, and in a Rorschach test his associations were poor in number and quality, and he showed some tendency to perseverate.

He was discharged from the Army and returned to his previous occupation. On 14.x.41 he wrote that he felt well and was picking up his old strength. He complained of some insomnia, but felt quite happy otherwise.

CASE 4.—Woman, aged 19, psychopathic personality of subnormal intelligence. Impulsive suicide under the influence of drink. Compound depressed fracture of skull with laceration of left temporal lobe. Transient aphasia, otherwise no change.

A. L. T—, aged 19, W.1 A.T.S. (R.I. No. 17948) was admitted to the Radcliffe Infirmary on 5.ix.41, after jumping from a first floor window about 20 ft. high. She had been unconscious, but on admission she was able to answer questions. She was in a state of deeply clouded consciousness, very restless, apparently frightened and repeated, "Don't hurt me, don't hurt me."

On examination she had a compound depressed fracture in the left parieto-occipital region; on operation a laceration of the brain under the fracture, i.e. of the posterior part of the temporal lobe, was seen and a spouting cortical vessel clipped. During the first day after the operation she recovered full consciousness gradually. She was paraphasic in the beginning and had considerable difficulty in naming objects. When transferred to a Military Hospital on 17.ix.41 she was free from focal signs.

She refused to give an account of her accident; she seemed childish, anxious and suspicious. Her sister who brought her to the hospital said that on the night of the accident she was seen in three different public houses with a soldier and then with a sailor. She was drunk when her father found her and tried to persuade her to go home. Finally he succeeded, but the girl threatened to throw herself out of the window when he forced her to go with him. The argument continued on the way and at home, and in an unobserved moment she jumped through the window.

Previous history from her mother: She was backward at school. On leaving she was still in Class 3, and when tested psychologically she was thought to be at least three years behind her age. But at this time there were no signs of behaviour difficulty. After leaving school she stayed at home to help her mother in the house. She then had domestic jobs; but though she would satisfy her employers at first, she threw up every job after a short time for no very good reason. She wanted to have her evenings free, because she wanted to get about with boys and men. As her parents could not cope with her, they sent her to a home for six months. After her return the same trouble started again, and she was sent to a stricter home, where she managed to stay away for two nights and finally landed at Skene House. There she behaved quite well and was placed in domestic work again. She changed again twice within a few months, and then enlisted for the Land Army, where she stayed for less than a month. She worked in a cafe for a while, and about three months before admission she joined the A.T.S. She did canteen work there and got a satisfactory report.

At the military hospital she behaved quite satisfactorily, though there was no doubt that she was childish and stupid. She was sent back to her unit, but could not readjust herself; sent back to the hospital again, she said frankly that she was fed up and wanted to get out of the A.T.S. She sulked, and when she could not get a promise that she would be boarded out she made another attempt at throwing herself out of the window. She was finally discharged unfit.

CASE 5.—Woman, aged 34. Average intelligence. Recurrent endogenous depression, precipitated and aggravated by circumstances. Mild concussion with quick recovery. No change of depression.

K. P—, aged 34 (R.I. No. 13653), was admitted on 4.x.41 after jumping out of a running train in a suicidal attempt. She had no recollection of her decision, or of opening the door of the compartment, in which she was travelling alone. She found herself lying near the line, with a bad headache. She was able to walk to the nearest house, and was taken to hospital by ambulance from there. She had abrasions all over the body, and a fracture of her left tibia; no fracture of the skull. The neurological examination was negative. Patient had been feeling depressed for the last two years, but more so since the previous February. At this time she took up nursing again, after a break of seven months, and the work was not quite what she expected it to be. They were under-staffed, and she had the responsibility for a large part of the hospital. Over-conscientious as she was, she started worrying whether she did everything right, and gave herself hardly any rest. She lost weight, and could not sleep. Her work satisfied the matron, who noticed no change in her behaviour or falling off in her efficiency. But she complained to Matron that her work was not satisfactory, and she came to apologize for leaving out the title "Daily Report" from her report—which seemed to Matron unnecessary. The week before her suicidal

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attempt she had spent with her husband (who is in the Army) at the house of her in-laws. They were happy together, and she seemed not unduly upset when they had to part again. But her husband thought her run down and over-worked, and made her promise to give up nursing. They travelled part of the way together, when he returned to his unit and she, travelling to her hospital and made the suicidal attempt.

Patient is an only child. Her father left her mother for reason unknown to her when she was a child of seven or eight. She was an average scholar, but shy, a bad mixer and had a lot of trouble with her stomach while at school. In retrospect she calls it "nervous." After leaving school she got a job in a shop which she did not like very much, and when she was 18 she took up nursing. She was always serious-minded and quiet, but not unsociable. She had several spells of depression, of several months' duration each, and once she was in a nursing home for a few weeks. Two years ago she had another serious "breakdown." She reproached herself for not being kind enough to her fiancé, for not satisfying herself and others, and for being unable to confide in anybody. She seemed to have made a suicidal attempt, but was found by her mother. Both are reluctant to go into detail. She got engaged to her husband 12 years ago; he had been a patient at her hospital. They got married at the beginning of 1941.

Patient recovered quickly from her concussion, but was still depressed and retarded when discharged in the care of a responsible relative. Six weeks later she started occupying herself with light housework and has since fully recovered.

Discussion.

Cases 1 and 2 are very similar in structure: Both were men of roughly the same age, well-adjusted personalities of the syntonic type, hard and conscientious workers; both developed gradually a state of depression while working strenuously, probably overworking themselves when their beginning depression made extra exertions necessary to keep up the standard of work.

No external cause for the depression is evident in either case, though in Case 2 the depression was aggravated by external circumstances. In both cases suicide was not really premeditated, but the result of sudden impulse after the patients had had suicidal thoughts for some time. In both cases the suicidal cerebral injury led to a sudden disappearance of the depression. The injuries in both cases were of the same order of severity, viz., extensive lacerations of the brain. There is one difference of great theoretical importance: in Case 1 the injury is bi-frontal, involving the left frontal lobe more than the right, but in Case 2 the left temporal lobe is lacerated, and there is nothing to indicate any involvement of the frontal lobes, either in the clinical picture or in the X-ray findings.

Case 3 is more complicated clinically. The patient's pre-morbid personality is slightly abnormal; he is shy and introverted, a stutterer, who is very conscious of this handicap and tries to overcome and to over-compensate it. His depression is much more acute and of much shorter duration at the time of the attempt. The latter itself seems to have been a play with suicide with an unfortunate end. It is, however, not out of the question that his overwork before the onset of what he calls depression was actually the beginning of his depression.

His recovery was equally sudden, accompanied by some transient "organic" apathy and lack of initiative. His willingness to return to his unit in spite of everything that had happened may even be interpreted as a slight lack of insight or error of judgment. But there were external factors operative in his recovery—his newly formed attachment to an officer, which, seen in the light of his previous personality, cannot easily be disregarded. The localization of the injury in this case corresponds closely to that in Case 1; the severity is demonstrated in the post-traumatic dilatation of the anterior horn of the left ventricle.

Case 4 shows the lack of effect of a suicidal cerebral injury on a psychopathic personality of low intelligence. The localization of this comparatively mild laceration was in the posterior part of the left temporal lobe.

Case 5 finally demonstrates the negative result of a suicidal attempt producing a mild concussion without signs of focal cerebral injury on an endogenous depression of moderate severity.

Every psychiatrist seems to know cases of depression which make a sudden recovery after psychological or physical "shock," but I have not been able to trace any case histories in the literature, and no information seems to be available about the mechanism of recovery. In particular one would like to know whether in the cases of recovery after physical shock, physiological or psychological reactions bring about the clinical change. In cases of suicidal attempts (not involving the brain) this distinction is difficult enough. In two such cases recently observed by

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the writer, psychological mechanisms were of obvious importance, but in neither case could one be definite about the further question, namely whether it was the relief of emotional tension by the suicidal act, or the change brought about in the patient's life-situation as the result of self-inflicted injury. The less complicated of the two cases may be quoted in brief:

C. B—, a borderline defective, aged 41, had lived and worked with his father all his life, sorting rags for low wages. He was always shy, had no outside interest or hobby; he did not smoke, drink, gamble or read. He used to listen to the wireless in the evenings. He never touched a woman. He used to have days or periods of a few days when he felt depressed or rather fed up with himself, mainly on account of his difficulty in mixing with people. He was never off work or under medical treatment, and never made a suicidal attempt. He was afraid of being called up, and became rapidly depressed when he had to join up, and after four days in the Army he thought it was too much for him and cut his throat with his pocket knife. He injured his trachea and was seriously ill for three weeks. When seen after that period he was not depressed; he denied any suicidal thoughts. He said he felt quite happy at the hospital because other people talked to him and he found it easy to mix. He intended even to play cards with other patients. He also expected to be boarded out of the Army.

Environmental factors like these cannot be disregarded in those three patients who recovered after their suicidal attempt. For all of them changes in their circumstances were brought about. The vicious circle of depressive retardation and overwork was broken; Cases 1, 2 and 3 never returned to military duty. Though in none of the cases was there anything to show any intention of getting out of the Army, it was obvious that they were ill-adjusted to their particular army condition, and this ill-adjustment played an important part in bringing about their depression.

As mentioned before, very little is known about the effect on the depressive state of physical illness as such, in other words of effects of the subjective awareness of being or having been seriously ill. But there is no doubt that the focusing of attention, both of the patient himself and the medical and nursing staff, from the mental to physical symptoms is important. Cerebral injury, with the particular psychological significance attached to the head, the impressive experience of the amnesia and the break in the continuity of existence are particularly liable to bring such factors into play. It is difficult to exclude their importance in cases like those quoted, and it is probably significant that the fifth case, an endogenous depression, did not improve after a mild concussion which did not produce the experience of being seriously ill. The absence of permanent symptoms and the lesser degree of violence in the attempt are other factors to explain the difference.

Allowing for the relative importance of these factors one would like to trace any specific significance of the cerebral damage in the improvement of these patients as regards their depressive states. The frontal euphoria and disinhibition is the feature which one would expect to neutralize, as it were, the depressive state. There are, however, two arguments which make such an interpretation very difficult, though Cases 1 and 3 at first sight would lend themselves to such an interpretation: (*a*) the lesion in Case 2, which was no less effective than that in the other two cases, was limited to the temporal lobe, and there was no reason to suspect that the frontal lobe was involved; and (*b*) in the two frontal cases no real frontal euphoria or disinhibition was present.

There is one case on record in the literature which corresponds much better to the anticipated picture:

M. Lebensohn published a case of a woman, aged 49, who in a state of depression shot herself through both frontal lobes. She was described as a good housewife, tidy, industrious, sociable and economical. However, seven years before the suicidal attempt she started drinking heavily, became tense and depressed, and unable to sleep. Several external causes made her depression worse in the subsequent years, and she made an unsuccessful suicidal attempt a year before the one in question. Following a trivial argument with her husband she shot herself with a ·25 calibre pistol. The entry wound was through the right frontal bone, and the bullet was lodged on the floor of the left anterior fossa, its nose pointing to the right—in other words it seemed to have ricocheted from some point of the left frontal bone. The patient had cerebro-spinal rhinorrhoea and a pneumocephalus. She made a slow recovery physically, at the same time passing through an acute frontal syndrome (fatuous euphoria and excitement). Re-examined three years after the event, she had readjusted herself to her home life, though she indulged sometimes in alcohol. She showed no intelligence defect, but her emotions were shallow; she

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was slightly euphoric or facetious, certainly not depressed; she had had no depression or suicidal ideas during the three years, and she was less concerned about some painful chronic arthritis than she had been before the injury.

The author mentions that many depressions have been cured by severe shock of general nature, but he points out that his patient's recovery hints at a more specific mechanism.

There is one example among Kleist's cases of a patient (Taucher, p. 1187) who developed fatuous euphoria, *Witzelsucht* and severe demoralization after a suicidal attempt (revolver bullet through the basal part of both frontal lobes, just missing the optic nerves, but leading to temporary blindness). This patient was an irritable and unstable personality to begin with, and he attempted suicide in a sudden outburst of anger following some quarrel with his wife.

These two cases illustrate very well the localization of lesions which produce this type of change of character. L. Welt was the first to point out that lesions of the orbital part of the frontal lobe produce this change of personality. Observations by Schuster in cerebral tumours, the present writer's observations in traumatic cases and Kleist's observations in cases of war injuries all seem to show that bilateral injuries to the basal part of the frontal lobe roughly corresponding to Brodmann's area 11, lead to euphoria, lack of insight, *Witzelsucht* and disinhibition. There is no agreement yet as to whether this clinical syndrome can be subdivided, and if so, whether more detailed correlations between the various components of the clinical picture and site of the lesion can be established. It is also open to discussion whether the clinical picture has any relationship to lesions of the base of the brain adjoining and posterior to the orbital gyrus.

Considering the positive and negative evidence the interpretation of the reported cases would go along the following lines: Euphoria and disinhibition are related to lesions of the basal parts of the frontal lobes; these regions were not affected in any of the cases. Correspondingly none of them showed the characteristic syndrome of the frontal euphoria. On the other hand, the two cases quoted from the literature with injury to the frontal base changed from depression into fatuous euphoria. Moreover, the recovery from depression was the same in the temporal as in the two frontal cases. Therefore the recovery from depression in the reported cases is not the result of a specific focal injury. Factors to account for the improvement are both physical and psychological. General damage to the brain and effect of injury and sickness on the organism on the one side, and on the other the release of tension, the substitution of recognized physical illness for hidden mental incapacity, the experience of interrupted consciousness and amnesia, finally the change of the life situation brought about by the injury, combine in bringing about the mental change. Case 5 might point to the relative unimportance of the suicidal act, and the importance of the severity of the injury, at least in the endogenous type of depression.

Summary.

Five cases of suicidal head injury are reported. Two endogenous and one reactive depression recovered mentally as the result of severe injury to the frontal lobes in two, to the left temporal lobe in one case. One psychopathic reaction with a laceration of the posterior temporal lobe showed no change. One recurrent endogenous depression was not influenced by a mild concussion. Comparing these cases with two cases found in the literature, the conclusion is reached that the recovery was not due to focal cerebral injury, but to the combined operation of physical and psychological factors which are discussed.

Acknowledgments.

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MEASURING ABNORMAL PATTERN ON THE REVISED STANFORD-BINET SCALE (FORM L).*

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INTRODUCTION.

IT has long been recognized that standardized tests of intelligence, when used with psychotic subjects, cease to be valid measures of *native* intellectual endowment. This does not mean, however, that it is useless to employ such tests in the study of the mentally ill. On the contrary, the intelligence test still provides us with the best objective measure of the *present* intellectual efficiency of the patient.

Much has been reported in the literature on the ability of psychotics in performing on various tests. It has been noted that schizophrenics show a selective decline in efficiency; that they have much greater difficulty with certain types of tests than with others. Several studies on psychotic performance with the 1916 Stanford Revision of the Binet have suggested that there may be more or less dependable peculiarities of sub-test arrangement. As yet, however, no very satisfactory method has been devised for measuring the presence or extent of this pattern in an individual Binet record. Furthermore, few reports of the use of the Revised Stanford-Binet Scale (Form L) with psychotic subjects have appeared in the literature. Yet this scale offers several advantages as compared with other tests. It covers a very wide range of difficulty; it calls for a wide variety of activities; it is probably the best standardized and certainly the most widely used of the intelligence tests. Thus there is already available a large amount of normal "control" data against which to examine results obtained under the special conditions of mental illness.

PRESENT STUDY.

Purpose.—In the present study an analysis is made of the performance of schizophrenic and non-psychotic subjects on the new (1937) Revision of the Stanford-Binet (Form L). The purpose is to determine:

1. The extent to which schizophrenic subjects differ from non-psychotic subjects of the same level of ability in respect to the relative difficulty of test-items within each year level, and—

2. Whether these differences can be used conveniently to re-score an individual's test performance for abnormality of pattern.

Subjects.—Test records for a total of 961 subjects form the data upon which the present study is based. Diagnostically the subjects are classified as follows:

Normal (non-psychotics)	463
Schizophrenic	287
,, (recovered)	84
Alcoholic	50
Neurotic	16
G.P.I.	20
Affective disorders	41

All subjects were tested by trained examiners who had had considerable experience in examining psychotic subjects and were accustomed to wide range testing.

* Part of this work was made possible by a joint grant from the Rockefeller Foundation to the Department of Psychiatry, University of Toronto, under the direction of Prof. C. B. Farrar, and the Department of Medical Research, under the direction of Prof. C. H. Best.

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All psychotic subjects were, at the time of the examination, resident in an Ontario Hospital, and the diagnosis used in the present study is that assigned by the medical staff of the hospital concerned.

METHOD.

(1) From the available records of schizophrenic subjects, 100 cases were selected in such a way as to include those in which the psychiatric diagnosis was most clear-cut and unequivocal, and in which the illness was most severe.

(2) From the available records of non-psychotic subjects, 100 cases were then selected in such a way as to form a comparable group in respect to mental age. Using one-year intervals, the distribution of the two groups in terms of mental age is identical.

(3) These two groups were then systematically compared in respect to the number of cases passing test-items within each year level from VI to SA3.

RESULTS.

In order to simplify and abbreviate the reporting of results, it is proposed to select a representative year level (Year XII) for purposes of illustration. It should be understood, however, that similar results were obtained at other year levels.

(1) *Abnormality of pattern.*—Within each year level, schizophrenic patients displayed a distinctive pattern of successes and failures quite different from that

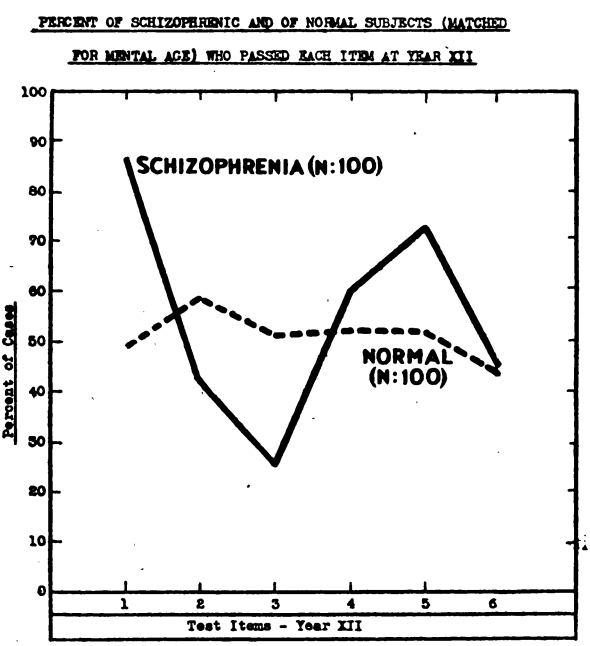

CHART I.

shown by non-psychotic subjects. Chart I shows this difference in pattern for the XII year level. It will be seen that whereas 86 per cent. of the schizophrenics passed test-item #1 at this level (vocabulary), only 26 per cent. of schizophrenics passed item #3 at the same level (response to pictures: Messenger Boy). In contrast to this wide difference in percent. passing for schizophrenics, the non-psychotic subjects show variation only from 59 per cent. on #2 to 44 per cent. on #6. Thus, test-items which are of approximately equal difficulty for non-psychotic subjects are found to be of widely differing difficulty for schizophrenic subjects.

At each of the 13-year levels studied, the variation in percent. passing was very much greater for schizophrenics than for non-psychotic subjects. (The

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average difference between lowest and highest items within each year level was 34 points for the former and only 10 points for the latter.)

(2) *Reliability of pattern.*—The reliability of this abnormal pattern of successes and failures within each year level for schizophrenic subjects was examined by arranging the cases in alphabetical order and making a separate analysis for the " odd " and for the " even " cases. Chart 2 shows the results of this analysis for Year XII. It will be seen that the same distinctive pattern is maintained by both halves of the group.

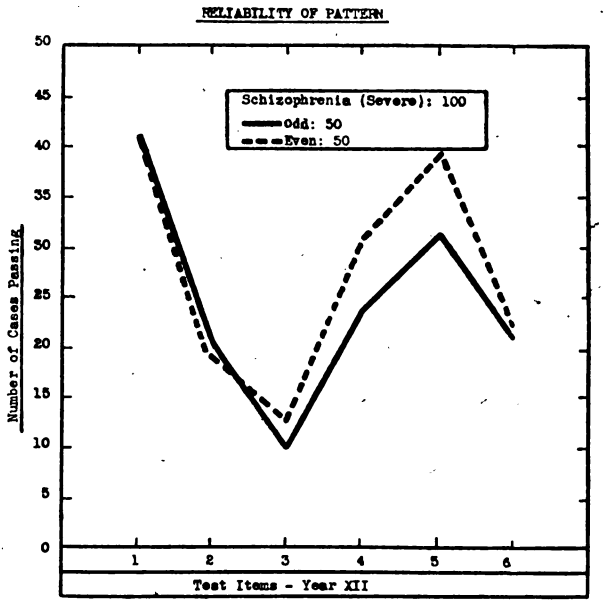

CHART 2.

At each year level the relative difficulty of items for schizophrenics remained the same and discrepancies, though present, were slight as in the illustration given.

(3) *Derivation of scoring key.*—The above results suggested that the schizophrenic pattern of successes and failures was sufficiently abnormal and sufficiently reliable to warrant an attempt to devise a method of scoring which would indicate the extent to which this abnormal pattern was present in any given test record.

Chart 3 shows in tabular form the method used in devising the scoring key. The key is a direct product of the difference between the two groups in per cent. passing each item. Plus indicates that the item is relatively easy for schizophrenics. The numerical value is simply a weighting based on the *extent* of the difference

CHART 3.—*Derivation of Score Values. Year XII.*

Test items.	Per cent. passing. Control.	Per cent. passing. Schiz.	Adjusted. Control.	Adjusted. Schiz.	Difference in per cent. passing.	Score value.
1	49	86	48	81	+33	+31
2	59	41	58	36	−22	−20
3	51	26	50	21	−29	−27
4	52	60	51	55	+4	+3
5	52	73	51	68	+17	+16
6	44	45	43	40	−3	−3
Average	51·1	55·2	50	50	0	0
Total deviation					108	100

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between the two groups. The weights have been adjusted so that the plus and minus values balance, and that the total possible weight for each year level is 100.

The score values shown in the last column should be interpreted as follows: The characteristic pattern for a schizophrenic operating at about this level of efficiency is to pass items 1, 4 and 5, and to fail items 2, 3 and 6. But of these items, #1 is by far the easiest for schizophrenics, and #3 is the most difficult.

(4) *Re-scoring individual test records for abnormal pattern.*—The method of re-scoring a test record is illustrated in Chart 4. A convenient form has been devised which makes it possible to re-score a test record for pattern in less than two minutes. One section of this form is shown for illustration. The blank form for Year XII is shown above. Below is shown the same form filled in for an actual test record. Where the key and the subject's record for an item are the same, a plus value is assigned to the numerical weight. Where they are different, a minus value is given. This procedure is repeated for each year level at which the subject had both success and failure. Totals for each year level are then transferred to a summary column, totalled, and the algebraic difference calculated. In order that pattern scores will be comparable from case to case, irrespective of amount of scatter, this difference is then divided by the number of year levels used in deriving it. Thus, pattern scores range from a theoretical maximum of plus 100 (identical with schizophrenic pattern) to a theoretical minimum of minus 100 (the exact opposite of the schizophrenic pattern).

CHART 4.—*Year XII.*

Weight.	Key.	Response.	Same.	Different.
31	+	..	..	..
20	—	..	..	..
27	—	..	..	..
3	+	..	..	..
16	+	..	..	..
3	—	..	..	..

Weight.	Key.	Response.	Same.	Different.
31	+	+	31	..
20	—	+	..	20
27	—	—	27	..
3	+	+	3	..
16	+	+	16	..
3	—	+	..	3
			77	23

The blank form for re-scoring any test record from Year VI to Year SA3 is reproduced in Chart 5.

(5) *Comparison of schizophrenic with non-psychotic subjects.*—Individual test records for the 100 schizophrenics (severe) and for the 100 non-psychotics (matched for mental age) were then re-scored for abnormal pattern in the manner described above. Test records for additional schizophrenics (including "mild") and non-psychotics were also re-scored.

CHART 6.—*Reliability of the Difference in Pattern Score between Schizophrenic and Non-Psychotic Subjects.*

Subjects.	Number.	Av. Sc.	S.D.	Diff.	S.E. of diff.	Diff. ÷ S.E.
(a) *Selected cases:*						
Schizophrenia (severe)	100	+44·0	21·28	48·6	3·63	13·4
Non-psychotic (matched)	100	— 4·6	27·53			
(b) *Other cases:*						
Schizophrenia (inc. mild)	156	+40·7	30·4	37·5	3·32	11·2
Non-psychotic	182	+ 2·2	30·5			

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CHART 5.

	VI					VII					VIII					IX					X				
	W	K	R	S	D	W	K	R	S	D	W	K	R	S	D	W	K	R	S	D	W	K	R	S	D
1	32	+				35	−				29	+				8	−				30	+			
2	45	−				28	+				29	−				11	−				18	−			
3	0					4	+				15	−				14	−				12	−			
4	18	+				6	−				6	−				17	−				7	−			
5	5	−				9	−				13	+				26	+				13	−			
6	0					18	+				8	+				24	+				20	+			

	XI					XII					XIII					XIV					AA				
	W	K	R	S	D	W	K	R	S	D	W	K	R	S	D	W	K	R	S	D	W	K	R	S	D
1	31	−				31	+				10	−				31	+				40	+			
2	19	−				20	−				17	+				7	−				12	−			
3	17	+				27	−				13	−				31	−				1	−			
4	11	+				3	+				7	+				12	−				7	−			
5	17	+				16	+				26	+				2	+				10	−			
6	5	+				3	−				27	−				17	+				16	−			
																					10	+			
																					4	−			

	SA1					SA2					SA3				
	W	K	R	S	D	W	K	R	S	D	W	K	R	S	D
1	41	+				38	+				44	+			
2	13	−				16	−				33	−			
3	23	−				12	+				1	+			
4	10	−				9	−				7	−			
5	9	+				3	−				10	−			
6	4	−				22	−				5	+			

SUMMARY			
Yr.	+	−	Diff.
VI			
VII			
VIII			
IX			
X			
XI			
XII			
XIII			
XIV			
AA			
SA1			
SA2			
SA3			
+		−	

W = Weight. K = Key. R = Subject's record. Insert weight under S if K and R are *same*, D if K and R are *different*.

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The difference between the averages, though smaller in the unselected cases than in the selected cases, is highly significant.

(6) *Correction for age.*—While investigating the relation of pattern score to various factors (see later section), it was discovered that for both psychotics and non-psychotics, scores tended to be somewhat higher with older subjects. Since the non-psychotics used were predominantly young (under 25) it was decided to collect additional Binet records of older non-psychotics. Routine clinic cases were supplemented with eleven convalescent public ward patients of a general hospital, all over 30 and presumably without psychological difficulties. All cases judged to be senile were rejected. In all, 463 non-psychotic records were used to obtain the correction for age. The average pattern score for each age-group of non-psychotics was found.

CHART 7.

Age group.	Number.	Average score.	Adjustment for age.
5 –9 years	50	−8	+8
10–14 ,,	112	−1	+1
15–19 ,,	117	+9	−9
20–24 ,,	62	+22	−22
25–29 ,,	26	+23	−23
30–34 ,,	18	+27	−27
35–39 ,,	20	+37	−37
40–44 ,,	21	+44	−44
45–49 ,,	15	+45	−45
50–54 ,,	9	+45	−45
55 up	13	+45	−45

The difference between zero and the average score for each age group was taken as the correction for age factor. Every score, psychotic and non-psychotic, was adjusted thus according to the age of the subject.

The differences between the averages of the two selected groups and of all available schizophrenics and non-psychotics are given below.

CHART 8.—*Reliability of the Difference in Pattern Score, Corrected for Age, between Schizophrenic and Non-Psychotic Subjects.*

Subjects.	Number.	Av. Sc.	S.D.	Diff.	S.E. of Diff.	Diff. ÷ S.E.
(*a*) *Selected cases :*						
Schizophrenia (severe)	100	17·7	21·82	16·4	3·218	5·096
Non-psychotic (matched)	100	1·3	23·46			
(*b*) *Schizophrenia :*						
Severe and mild	287	13·5	23·50	14·37	1·967	7·305
All non-psychotics	463	−0·8	27·105			

The differences between averages, though less than for the scores uncorrected for age, are still highly significant. The distribution of pattern scores corrected for age of all schizophrenics and non-psychotic subjects is found in Chart 9.

(7) *Relation of score adjusted for age to other clinical conditions.*—Average scores for patients who were classed as recovered (44) and social remission (39), as well as averages for relatively small groups of mental hospital patients belonging to various other diagnostic categories, are given in Chart 10.

CHART 10.—*Other Clinical Conditions.*

Type.	Number.	Average adjusted for age. (Diff. from normal zero.)
Schizophrenic—Recovered and social remission	84	−3·4
Affective disorders	41	+3·7
Alcoholic	50	+4·6
G.P.I.	20	+10·5*
Neurotics	16	−1·8

* The difference is over twice its standard error.

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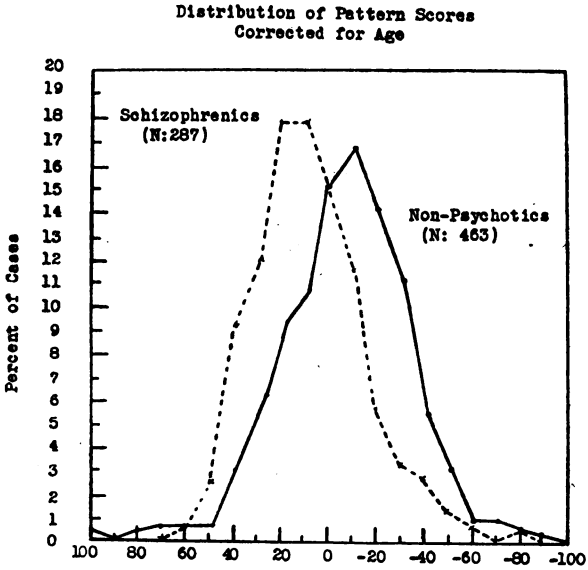

CHART 9.—Pattern score. Corrected for age.

	Aver.	σ	Diff.
Schizophrenics +	13·55 ±	23·5	14·37
Non-Psychotics −	0·82 ±	27·105	

$$\frac{\text{Diff.}}{\sigma \text{ Diff.}} = \frac{14{\cdot}37}{1{\cdot}967} = 7{\cdot}3$$

It will be noted that recovered schizophrenics and neurotics tend to have " normal " scores ; the average of the G.P.I. group is almost as high as the non-recovered schizophrenic group, while affective disorders and alcoholics fall between.

(8) *Relation of score to other variables.*—In an effort to determine whether pattern score is related to any of the other known characteristics of the subject, cases in each of the initial groups (100 schizophrenics and 100 non-psychotics) were divided into quartiles according to pattern score corrected for age, and these quartiles compared in respect to other characteristics.

On the basis of this analysis the size of pattern score does not seem to be significantly related to sex, examiner, type of onset (gradual or sudden), mental age, or sub-type of schizophrenia.

As was noted above, pattern score was found to increase with age, both for schizophrenics and non-psychotics, necessitating an adjustment of score for age. The implication seems to be that normally from the second decade up there is a progressive differentiation between certain abilities similar enough to that found in schizophrenia to cause an increase in " psychotic pattern score." Wechsler (14) and others note such a progressive differentiation with age. He found that vocabulary ability was preserved to an advanced age, and other verbal tests showed some decline, while non-verbal tests declined much more rapidly with age.

(9) *Qualitative description of abnormal pattern.*—While our main objective in the present study has been to determine whether there is a dependable abnormality of pattern in Binet performance displayed by schizophrenics, and if so whether this pattern can be conveniently measured, it will be of interest to report briefly the nature of this pattern in terms of the arrangement of test items. This is shown in Chart 11.

The test items at each year level have been arranged according to their weighted score value. It will be recalled that items with a plus value (above the midline) are relatively easy for schizophrenics. Items with a minus value (below the midline) are relatively difficult for schizophrenics.

Detailed examination shows that the arrangement of test items within each year level is strikingly consistent over the whole range studied. For example,

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CHART II.—*Arrangement of Test Items according to Score Value.*

Score value.							
50—							
40—							
30—	Vocabulary	Simil.	Vocabulary	Making Change	Vocabulary	Abstract Words	Vocabulary
20—	Number concepts	Digits		Digits	Digits	Prob. Sit.	Abstract Words
10—			Compreh. Memory (Sent.)			Memory (Sent.) Simil.	
0—	Mut. Pict.	Diamond					Digits
	Maze						Minkus
10—	Pictorial Likeness	Compreh. Analogies	Simul.				
20—			Absurd (Verb)	Paper Cutting	Reasons Report Word Naming		
30—		Absurd (Pict.)	Memory (story)	Absurd (verb) Memory (Designs) Rhymes	Absurd (Pict.)	Absurd (verb) Memory (Designs)	Absurd (verb) Pictures
40—	Bead Chain						
50—							
Year Level	VI	VII	VIII	IX	X	XI	XII

CHART II—*continued.*

Score value.							
50—							
40—			Vocabulary	Vocabulary	Vocabulary	Vocabulary	
30—	Dissect. Sent.	Vocabulary					
20—							
10—	Memory (Words)	Abstract words					
0—	Problems of fact	Orientation	Memory (Sent.) Abstract words	Sentence building	Digits	Digits Opposites	
10—	Plan of search Paper cutting	Induction Ingenuity	Opposites Arithmetic Proverbs Codes Ingenuity	Simil. Digits Enclosed boxes	Opposites Proverbs Reasons Repeating thought	Paper cutting Reasoning	
20—	Bead chain						
30—		Absurd (Pict.)		Minkus		Orientation	
40—							
50—							
Year Level	XIII	XIV	A.A.	S.A.1	S.A.2	S.A.3	

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vocabulary is (for schizophrenics) relatively the easiest item at every year level at which it appears. Giving the meaning of abstract words and repeating digits (forwards and backwards) are also relatively easy. On the other hand, absurdity test items, both pictorial and verbal, as well as memory for designs and for stories are relatively difficult for schizophrenics wherever they occur. Thus it is apparent that the abnormality of pattern is qualitatively consistent from year level to year level.

The outstanding features of this pattern can be indicated in summary form by calculating the average score value of those types of test items which recur at successive year levels. Such a summary is presented in Chart 12.

CHART 12.—*Qualitative Summary* (*Schizophrenic Pattern*).

Cp. to other items in *same year level.*

Number of levels.		Average score value.
	EASY.	
9	Vocabulary . .	+35
4	Abstract words . .	+12
3	Memory for sentences	+10
6	Repeating digits .	+10
	HARD.	
4	Absurdities (verbal) .	−16
3	Memory for stories* .	−21
3	Absurdities (picture) .	−28
4	Memory for designs† .	−29.

* Incl. X : 3 & S.A.2 : 6. † Incl. VI : 2 & XII : 6.

While it is interesting to speculate concerning the possible explanation for these differences in relative difficulty, such speculation will not be attempted here. It may be noted, however, that the findings presented in this chart cut directly across traditional psychological categories in that, while "memory" for word meanings, sentences and digits remains relatively unimpaired, "memory" for stories and designs is seriously reduced.

These results find much indirect confirmation in the results reported by other investigators. The relative superiority of schizophrenics in vocabulary performance has been repeatedly observed. Wells and Kelly (15), Dearborn (8), Babcock (2 and 3), Schwarz (11), Wittman (17), Simmins (12), Altman and Shakow (1), and Davidson (7) are among the investigators reporting this peculiarity. Relative inefficiency in detecting absurdities has been reported with other test procedures by Wentworth (16), Hunt (9), Altman and Shakow (1) and Cameron (6). The studies reported by Vigotsky (13), Kasanin and Hanfmann (10) and Bolles and Goldstein (4), in which schizophrenics are reported to be especially deficient in "abstract" or "conceptual" thinking, are also in line with the findings here reported. The work to date, both on normal changes in mental test ability with increasing age, and on results of intelligence tests in psychosis, has been well summarized by Brody (5).

SUMMARY.

Using the 1937 revision of the Stanford-Binet Scale, the test records of 100 schizophrenic patients, when compared with those of 100 non-psychotic subjects matched for mental age, reveal a marked abnormality of pattern. This abnormality of pattern is found to be both reliable and consistent throughout the scale. A method for quickly detecting its presence in an individual test performance has been devised. The magnitude of the measurement of this pattern is found to increase with age, and an adjustment of pattern score based on 463 non-psychotics of various ages has been made.

Statistically significant differences in average pattern score (adjusted for age) between schizophrenic and non-psychotic subjects are reported. Recovered schizophrenics and neurotics do not display a similar abnormality of pattern, while other groups of abnormal subjects are found to have abnormal patterns of varying degrees. The general nature of this abnormality is described.

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The authors wish to express their appreciation to the superintendents of the Ontario Hospitals, and to Dr. H. K. Detweiler, Physician-in-chief of the Toronto Western Hospital, for permitting the psychological examination of patients in their wards.

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Part II.—Reviews.

War in the Mind: The Case-Book of a Medical Psychologist. By CHARLES BERG, M.D., D.P.M. London: The Macaulay Press, 1941. Pp. 272. Price 8*s.* 6*d.*

A well written and well selected series of case histories described by a psycho-analyst in such a form as to be suitable for popular consumption. The majority of the more common psycho-pathological states are represented and there are verbatim reports of the free associations at critical phases of the analyses. A few analysands are chosen to illustrate the transference situation and how it is dealt with. Four war neuroses are included; the analysis makes it clear that psychotherapy, stopping short at the immediate situation, does little good. The war crisis is merely a screen memory for or precipitating factor in bringing to the surface unresolved infantile conflicts. A short chapter at the end of the book deals with the theory of psycho-analysis. It includes sections on technique, transference analysis, and the topography of the mind.

The book gives a very clear picture of the various psychological mechanisms at work in the abnormal mind. Besides the lay reader, for whom it is primarily intended, it might well be of value to the student, if read in conjunction with a textbook on psychopathology.

S. M. COLEMAN.

A Practical Method of Self-Analysis. By E. PICKWORTH FARROW, M.A., D.Sc. London: George Allen & Unwin, Ltd., 1942. Pp. xvi + 154. Price 6*s.*

Analysis along orthodox lines having only provoked a strong negative transference towards two successive analysts, the author devised and carried out a form of self analysis. The method, the essence of which is to write down all that comes into the head during free association, is described in detail. During a period of 450 analytic hours the author succeeded in recovering three lost memories, which he holds responsible for certain immediate maladjustments. The memories were a severe castration threat aged 3 to 4, a slap at the age 11 to 14 months, and a more significant slap by his father at the age 6 months.

Mr. Farrow concludes that castration threats may have lasting influence on the child's psyche, and in particular slaps at a tender age may have severe repercussions on his feeling of omnipotence and future happiness as well as favouring serious complexes. It should be noted that the evidence regarding the age at which he received these slaps is by no means conclusive.

Certain alternatives, hardly considered by Mr. Farrow, are suggested here. The subject may have been innately determined to over-react to slaps and blows. Most young children suffer punishment but succeed in growing up into "normal" adults; perhaps in this specific case two slaps were not enough. If the Freudians are to be believed, civilization and reasonable social behaviour is a result of the castration complex. It is true that without this accentuation of the complex Mr. Farrow might have grown up omnipotent and happy, but would he have made a more satisfactory citizen? On the whole one is inclined to sympathize with the author's father and his surrogates, the two analysts.

Potential analysands, especially those with anal-erotic traits, will not fail to see the advantages of Mr. Farrow's method. On the other hand, it is likely to find less favour with aspiring psychotherapists.

S. M. COLEMAN.

Race, Reason and Rubbish. By GUNNAR DAHLBERG, M.D., LL.D. London: George Allen & Unwin, Ltd., 1942. Pp. 240. Price 8*s.* 6*d.*

In this book an authority on genetics applies his findings to current problems. He shows, for instance, that the belief that forms of mental defect and other hereditary diseases can be stamped out by sterilization or the prohibition of consanguineous marriages is based on a misconception of the laws of genetics. These conditions are comparatively rare, are already subjected to laws of natural selection far sterner than could be brought about by any law of sterilization and yet they have not been eliminated. The reason for this is that where a recessive character is rare, the proportion of people in whom the gene is latent is comparatively high.

Some of the author's psychological deductions are open to criticism. It is right that the shepherd should know that he is not going to obtain a flock which gives birth to twins by breeding

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from those with supernumerary nipples. On the other hand, should the cattle-fancier be condemned because, instead of valuing a bull on the milk-yield of its forbears and progeny, points are also given for colour, set of tail, head, horns and neck, etc.? For the author the aesthetic factor in stock-breeding is meaningless. The same point of view is adopted towards the colour bar. It is shown irrefutably that a white man is no better intellectually than his black brother. Therefore, in the author's opinion, there should be no bar on cross-breeding. The fact that there is a nordic ideal of physical beauty and that the mulatto does not conform to this standard is ignored. The author, fully armed from the genetic standpoint, approaches psychological problems with massive confidence. Convinced of the all-importance of the intellect and of utilitarian values, he misses the subtleties of the psychological approach and totally ignores aesthetic values. He would be certain to take the Socratic proof that he was more beautiful than Critobulus in all seriousness.

Like the rest of the civilized world the author is shocked at the Nazi oppression of the Jews. He finds that morally and intellectually the Jews are no better or worse than the rest of humanity. He then proceeds to reason that antipathy to an "isolate" has no foundation in fact or logical justification. But a community is made up of "isolates"—the public-school boy, freemasons, trade unions, class groups, to mention just a few. Membership confers privileges, often most unjust to those outside and as often regardless of merit. The more exclusive the group and the greater the privileges, the more marked the resentment and hostility of the rest of the community. It is man's nature to form "isolates," the most basic and strongest being, of course, the family. The family has the strongest emotional ties and in many ways it is the most illogical.

S. M. COLEMAN.

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Part III.—Bibliography and Epitome.*

AN attempt is being made to provide as far as possible a complete bibliography compiled from the specialist journals dealing only with Psychiatry and Neurology (which are really inseparable) and their ancillary subjects, psychology, anatomy of the nervous system, criminology, etc.

A number of titles may appear to have a very remote relation to psychiatry, but they are included for the sake of completeness.

If any reader can add the names of journals to the following list, which it is hoped to publish each year in the January number, the addition will be gratefully received and acknowledged.

Those journals which are available in the Library of the Royal Medico-Psychological Association are marked " 1," those available in the Library of the Royal Society of Medicine are marked " 2," those in the Library of the British Psychological Society are marked " 3," and those in the Library of the British Medical Association are marked " 4."

The titles of these journals are mostly in the form given by the Board of Editors of Publications of the American Psychological Association, January, 1939. Contributors are requested to use the exact form given below.

PSYCHIATRIC JOURNALS.†

Abh. Neur. Psychiat.
Abh. Psychother.
Acta Espanola Neur. y Psiquiat, Kbh.
2, 4 *Acta Psychiat. et Neurol.*
3 *Acta Psychol., Hague.*
Acta Psychol., Keijo.
Aliéniste Français.
2 *Allg. Zischr. f. Psychiat.*
Altersprobleme.
Am. Imago.
Am. J. ment. Def.
2, 3 *Am. J. Orthopsychiat.*
1, 2, 3, 4 *Am. J. Psychiat.*
2, 3 *Am. J. Psychol.*
An. Bras. Hig. Ment.
An. Inst. Psicol. Univ. B. Aires.
An. Psicotec., Rosario.
Anal. Istit. Neurol., Montevideo.
Analele Psihol. (Rumania).
Anales de psicologia, Buenos A.
2, 3 *Année Psychol.*
2 *Ann. Méd. Psychol.*
2 *Ann. Osp. psichiatri., Perugia.*
Arb. Psychiat. Inst., Sendai.
Arch. Anthrop. crim.
2 *Arch. Argent. de Neurol.*
Arch. Argent. Psicol. norm. pat.
2 *Arch. Bras. de Neur. e Psiquiat.*
Arch. Brasil Hig. Ment.
Arch. Chilenos de Crim.
Arch. Ital. di Studi Neuropsich.
1, 2 *Arch. Neurobiol.*
4 *Arch. Neurol., Paris.*
Arch. de Neurol. de Bucarest.
1 *Arch. de Neurol.*
2 *Arch. di Antropol. Crim.*
Arch. di Criminol. Neuropsiquiatria Disciplina y Conexas, Quito.

* A number of abstracts in this section are reproduced from *Chemical Abstracts and Psychological Abstracts*. To the Editors of these two Journals we extend our grateful thanks.

† Some of these Journals may have ceased to exist.

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2, 4 *Arch. f. Psychiat.*
2, 3 *Arch. ges. Psychol.*
Arch. Internationale de Neurol.
Arch. Ital. Psicol.
Arch. Krim. Anthrop.
1, 2, 3, 4 *Arch. Neurol. Psychiat.*
Arch. Neur. Psychiat., Mex.
2, 3 *Arch. Psicol. Neurol. Psichiat. e Psicoter.*
2, 3 *Arch. Psychol., Genève.*
3 *Arch. Psychol., N.Y.*
Arch. Relig. psychol.
Arch. Speech.
Arquivos da Assist. a Psicopatas de Pernambuco.
3 *Austr. J. Psychol. Phil.*

Beih. Z. angew. Psychol.
Beih. Zbl. Psychother.
Bol. Inst. Psiquiatria, Rosario.
2, 4 *Brain.*
3 *Brit. J. Educ. Psychol.*
2, 4 *Brit. J. Inebriety.*
2, 3, 4 *Brit. J. Med. Psychol.*
2, 3, 4 *Brit. J. Psychol.*
3, 4 *Brit. J. Psychol. Monogr. Suppl.*
Bull. Canad. Psychol. Ass.
2, 4 *Bull. de la Soc. de Psychiatrie de Bucarest.*
2 *Bull. de la Soc. Roumaine Neur. Psychiat. Psychol. Endocrin.*
Bull. du Groupement Français d'études de neuro-psychopathologie infantile.
2 *Bull. Los Angeles Neur. Soc.*
Bull. Menninger Clin.
Bull. Soc. Psihol. med., Sibiu.

4 *Canad. Journ. Occup. Ther.*
3 *Cath. Univ. of Amer. Studies in Psychol. and Psychiat.*
2 *Cervello.*
2, 3, 4 *Character and Per.*
2 *Child Develpm.*
Child Develpm. Abstr.
Child Develpm. Monogr.
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Chin. J. Psychol.
3 *Comp. Psychol. Monogr.*
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1, 2, 3, 4 *L'Encéphale.*
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Index Neurol. y Psiquiat, Buenos Aires.
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J. Psychol., Moscou.
J. Psychol. Neurol., Leipzig.
2 *J. Psychol. Norm. Path.*
J. Soc. for Psychical Research.
3 *J. Soc. Psychol.*
J. Speech Disorders.

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Ment. Health.
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Ment. Hyg. Bull., Indiana.
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Nowiny Psychjatryczne.
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2 *Occup. Ther. and Rehabil.*

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2 *Ospedale Psichiatrico.*

Person. J.
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Polsk. Arch. Psychol.
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Proc. Amer. Assoc. Stud. Ment. Def.
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Psichotec.
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Psychol. wychow.
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Rass. Neurol. Veget.
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Rev. Argent. Neurol. Psiquiat.
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Rorschach Res. Exch.

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1 *Schizofrenic.*
2 *Schweiz. Arch. Neurol. Psychiat.*
Skand. Arch. Psychol.
Sovet. nevropatol., psichiatri, psichoguoguia.
Sovet. Psichoneurol.
Sovet. Psikhotekh.
Speech Monogr.

Tohoku Psychol. Folia.
Tr. Am. Neurol. A.
Tr. Beritov. Inst., Tiflis.
Tr. Kostchenko Ment. Hosp., Moscow.
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Trud. tsentrul. psikhonevrol. Inst.

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Z. Arb. Psychologie.
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Zbl. Psychotherap.

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Prognosis in Manic-Depressive Psychoses:

A follow-up study of 208 manic-depressive conditions is reported. Analysis of such conditions permits the following summary:

Positive heredity is common—chiefly depressions, and more commonly in the direct line of heredity. This shows more consistently in the manic cases. Characteristic personality type is outgoing. Unexplainable psychosis is rare (20 per cent.). Most have disturbing circumstances at the time of onset. Oldest and youngest siblings may more frequently develop psychoses. Somatic handicaps frequently contribute to or help to precipitate the illness. Abrupt onset is rare except in manics. The condition usually requires one to six months to develop. Suicidal risk or attempt occurred in 30 per cent. of all cases. The affective picture is often mixed, not purely as sadness or elation. Psychoneurotic (not often as anxiety), schizophrenic, and arteriosclerotic components are frequent (79 cases) (33·1 per cent.). Thinking disturbances are present in one-fourth of the cases (manic and depressive phases). Capacity for rapport is fair or good in 41 per cent. of the manics and in 70 per cent. of the depressions. Some insight is present in 47 per cent. of the manics and in 54 per cent. of the depressions. Remissions of 10–20 years are common (67 cases, 32·2 per cent.). Depression may begin early but rarely (3·8 per cent., 8 cases), or late (65 + 11 cases, 5·2 per cent.). The largest incidence occurs in the decade 45–55. Course is a matter of months; on the average 2½ months in the hospital. Three-fourths of the cases are well or improved at the time of discharge; 93 per cent. recover from the first attack. Chronic cases are rare (16, 7·7 per cent.). Cyclothymic cases tend oftener to chronicity. Single attacks are rare (21 per cent.). Recurrence is likely. Long-term follow-up convinces us that caution is necessary in pronouncing recovery for the future. Seventy-nine per cent. had recurrences. This is particularly true for cyclothymic cases. Many variations in course and phases occur. Depression following elation is more common than vice versa. Depression almost always lurks behind elation. Manic patients may suicide. Depressive or paranoid content occurred in 14 of the manic cases (77·7 per cent.). Depressive cases may show definite manic features (spurts of elation in the morning, rhyming and flight with sadness). Single attacks of manic psychosis are very rare. Single attacks of depression occurred in 40 cases (19·2 per cent.). Fourteen of these became chronic (35 per cent. of 40 and 6·8 per cent. of 208). The unfavourable depressions may develop a schizophrenic picture. Deterioration may occur in depression. Stupor in depression occurs—catatonic in appearance. First attacks on the average last 6½ months. Recovery from first attack is almost invariable (93 per cent.). Twenty-one per cent. had single attacks; 79 per cent. had recurrent illnesses; 63·5 per cent. had third attacks and 45·1 per cent. had fourth attacks. Attacks tend to become prolonged as they recur, especially after 45. Best prospect for recovery for patients having first attack is between 21 and 30, poorer after 40, worst after 50. Recovered patients show small number of attacks (2·7) and shortening of the course in subsequent attacks. The more frequent the attacks the less chance for ultimate recovery. Depth of psychosis is not significantly important. Negative heredity is not an outstanding factor in recovery. Out-going make-up is a factor in recovered cases. (Author's abstr.)

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Hypochondriacal Complaints with Special Reference to Personality and Environment.

1. The issue of hypochondriasis has been confused through its identification, on one hand, with somatic delusions in psychoses and, on the other, with any and all somatic disorders of functional origin. This study supports the thesis that there exists a clinical nosological entity, called hypochondriasis, as here defined.

2. Hypochondriacal patients, with very few exceptions, have numerous complaints. These involve organs, systems of organs, the whole or parts of the body not referable to any special organs. In contrast to their usual diffuseness, the complaints in a few of our patients are circumscribed, warranting the term monosymptomatic hypochondriasis.

3. The only common and very outstanding characteristic of hypochondriacal individuals is their unusual, peculiar hypochondriacal attitude towards health and sickness. The consistency of such an attitude and its persistence more or less overtly throughout life leads one to speak of constitutional hypochondriasis. However, aside from the hypochondriacal attitude, both male and female patients with hypochondriacal reactions do not, all of them, otherwise show distinctly characteristic personality traits. They rather present a rich collection of varied human specimens.

4. It is granted that in the hypochondriacal reactions of our patients, their special personality make-up played the all-prevalent part. Yet from our material it is also clear that envifonmental influences, including iatrogenic factors of long and short duration, equally contributed their share. (Author's abstr.)

The Relationship of Vitamin C Deficiency to Dental and Gingival Conditions in Mental Patients.

(1) Quantitative vitamin C studies done on mental patients reveal levels considerably lower than normal.

(2) These low levels have been, at least partially, traced to the low vitamin C allowances in most institutional diets, but undoubtedly also on the unusual food habits of mental patients, depending on their delusions regarding food.

(3) A definite correlation has been found between the frequency of dental and gingival conditions in mental patients and their low ascorbic acid levels.

(4) No significant differences were found in the various diagnostic groups, except that the lowest findings were in the alcoholic psychoses.

(5) It is recommended that hospital diets be supplemented by an adequate vitamin C supply. (Authors' abstr.)

Postural Reactions to Vestibular Stimulation in Schizophrenic and Normal Subjects.

(1) Postural reactions to caloric stimulation of the vestibular organ were measured in a group of 20 chronic schizophrenic patients and in a group of 20 normal persons. The blindfolded subjects were instructed to mark time in place, and the reaction was measured by the degree of rotation about the vertical axis of the body.

(2) The test was first administered without vestibular stimulation in order to determine the amount and direction of the rotation, which is an expression of the dominance of one side of the body. Such " basal trends," which were present in all subjects, were taken into account when calculating the amount of vestibular reaction.

(3) The mean total vestibular reaction measured in degrees of rotation was, in the patients, less than one-half that of the normal subjects. In spite of the great variability of the phenomenon studied, this difference is statistically highly significant.

(4) The total duration of the reaction, as well as the degree of rotation per time unit, was found to be significantly less in the patients than in the normal controls. That is, the reaction of the patients was more fleeting and less intense than that of the normal controls.

(5) It is suggested that the difference found may be due either to the depressed activity of the nervous mechanisms involved or to a diminished muscle tonus of the schizophrenic patients. (Authors' abstr.)

The Blood Sugar during and after the Hypoglycemic Coma of Insulin Shock Therapy, with Special Reference to the "Aftershock."

(1) Coma due to administered insulin does not generally occur while the blood sugar drops.

(2) The blood sugar remains at about the same level after the lowest point has been reached throughout the coma.

(3) Following the termination of the insulin coma, the blood sugar describes a characteristic curve with a sharp ascending and descending branch. In a majority of patients the blood sugar drops to hypoglycemic levels.

(4) "Aftershock" occurs a definite time, 4 to 6 hours, following the termination of the insulin coma, more frequently in female patients.

(5) The " aftershock " is due to a spontaneous hypoglycemia and occurs suddenly, probably simultaneously with the dropping of the blood sugar.

(6) The spontaneous hypoglycemia is due either to a depletion of glycogen in the liver, or to a functional disturbance in the carbohydrate metabolism. This disturbance is of a temporary nature, as found in patients with faulty dietary habits.

(7) The spontaneous hypoglycemia calls forth the same response as the hypoglycemia due to administered insulin, namely, a stimulation of the adreno-sympathetic system.

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(8) The " aftershock " not infrequently has appeared to produce a marked clinical improvement. This improvement may be utilized for practical purposes.

(9) The " aftershock " can be avoided by administration of carbohydrates three to four hours following the termination of the insulin coma. (Author's abstr.)

Recurrent Convulsive Seizures in Animals Produced by Immunologic and Chemical Means.

Acute, intermittent and recurrent convulsive seizures have been induced in monkeys by the application of discs containing various immunologically and chemically active substances to the cerebral cortex overlying the motor area. Acute seizures were either single attacks, or a series which usually terminated within one week of onset. Intermittent seizures occurred at widely-spaced intervals over a period of weeks or months. Recurrent seizures were frequent in occurrence (often daily) and persisted for many months. The seizures induced were either typically Jacksonian in nature, or generalized, and usually lasted one-half to two minutes. During unilateral seizures the attack was confined to the muscle groups on the side of the body contralateral to the treated cerebral hemisphere. Seizures occurred either spontaneously, or were induced by external stimuli.

Egg-white placed on the brain of monkeys generally sensitized to egg-white, or egg-white injected intravenously into animals in which egg-white had previously been applied to the cortex, yielded acute seizures. Egg-white, egg-white followed by anti-egg-white rabbit serum, specific antigen-antibody precipitates and typhoid vaccine proved to be effective agents in the production of intermittent seizures.

Hydrous oxides of aluminium, alone or in combination with various proteins, invariably produced convulsive seizures, often recurring for many months (in one instance for more than one year to date). These recurrent seizures were of special interest, since they represented a state of chronic convulsive reactivity.

Control preparations of aquaphor, alone or in combination with rabbit serum, monkey serum or gelatin, or empty discs failed to induce seizures.

Electric shock revealed a lowered threshold of convulsive reactivity of one motor area as compared with the other in monkeys exhibiting either unilateral or predominantly unilateral seizures.

Electroencephalography indicated that the greatest degree of abnormality in monkeys with convulsive seizures was observed in the precentral cortex and the immediately surrounding area. The recordings also established differences between the two motor areas which were correlated with differences in the clinical manifestations observed on the opposite sides of the body.

Luminal and dilantin were found to reduce the incidence of the recurrent seizures produced.

Serologic studies revealed no correlation between the concentration of serum precipitins or agglutinins and the occurrence of seizures. Brain antibodies were not demonstrable.

The histopathologic findings were of two main types: (1) an acute, destructive process; (2) a chronic, proliferative type of response. The acute lesion was usually associated with the acute or intermittent convulsive seizures produced by immunologic agents. The chronic pathologic response was found in monkeys treated with alumina, aquaphor preparations or empty discs, and was not pathognomonic of the convulsive state.

Repeated convulsive seizures have been produced by a single application of various types of substances to the cerebral cortex. Although the mechanism remains obscure, the methods employed may prove useful in further studies of the nature of the convulsive state.

(Authors' abstr.)

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Latah: An Exotic Psychoneurosis.

Natives in subservient positions in Java and Arabs living in Africa sometimes develop a neurosis in which they imitate quick movements and speech, usually of their masters. Instead of obeying instructions, they merely repeat them. Latah differs from hysteria found in occidental countries in that the patient shows great resistance and anguish and often becomes very angry when he feels compelled to imitate. It differs from catatonia in the good contact the patient has with his environment. While the natives tend to worship psychotics in general, they make fun of latah sufferers. Latah seems to be a very personal relationship; the symptoms can be evoked in only one patient at a time, and a patient will imitate only one person at a time.

M. B. MITCHELL (Psychol. Abstr.).

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Regulation of Cerebral Carbon Dioxide.

The response to overventilation and to breathing an increased concentration of carbon dioxide was studied in 13 subjects with normal electroencephalograms and no clinical evidence of cerebral disorder. Two of the subjects were chosen because they showed an unusually rapid increase in amplitude and decrease in frequency of cortical potentials with overventilation. Simultaneous samples of blood were taken from the femoral artery and the internal jugular vein, and the values obtained for carbon dioxide content, pH carbon dioxide tension and oxygen saturation were compared and correlated with simultaneously obtained samples of the electroencephalogram.

1. The dilatation or constriction of cerebral arterioles which follows an increase or decrease of carbon dioxide in the arterial blood serves to protect the brain against undue shifts in carbon dioxide tension.

2. The slow waves that appear in the electroencephalogram with overventilation are caused by a drop in cerebral carbon dioxide, and not by anoxia secondary to cerebral vasoconstriction.

3. The ease with which such slow waves can be produced with overventilation is a rough index of the relative incompetence of the cerebral vasoconstrictor response to low carbon dioxide tension.

4. In some supposedly healthy adults and in most persons with *petit mal* epilepsy, the cerebral vasoconstrictor response to low carbon dioxide tension is defective, this defect resulting in abnormal slowing of the electrical activity of the cortex during overventilation.

5. The cerebral vasoconstrictor response to low carbon dioxide tension disappears when a critically low level of oxygen tension is reached. (Authors' abstr.)

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Pathologic Changes in the Central Nervous System in Experimental Electric Shock.

Twenty-eight rabbits and ten rats were subjected to electric shock treatment simulating the treatment of patients with "functional psychoses."

Sixteen rabbits were paralyzed in the course of this treatment, seven of them after the first shock. In only three of the remaining twelve rabbits was no pathologic change found on microscopic examination In all the others hemorrhages were present within the meninges of the brain and spinal cord and within the brain stem and the spinal cord. These hemorrhages were usually confined to the immediate neighbourhood of capillaries and small veins and were produced by the rupture of the walls of these vessels. A combination of causes was responsible for these ruptures: the sudden rise of the arterial blood pressure during the forceful contraction of the musculature, the vasospasm of the peripheral arteries following cessation of the electric stimulation and the stasis in the venous system, which was aggravated by cessation of respiration for several seconds. Hemorrhages also were present in the lungs of six and in the kidneys of three out of ten rats subjected to electric shock.

No generalized ganglion cell disease or generalized proliferative glial reaction was observed. Such phenomena were confined to the immediate proximity of the hemorrhages, and were usually combined with a somewhat farther-reaching edema of the surrounding tissue.

(Authors' abstr.)

An Encephalographic Ratio for Estimating Ventricular Enlargement and Cerebral Atrophy.

The ratio of the transverse diameter of the anterior horns to the internal diameter of the skull as measured on encephalograms (or ventriculograms) exposed in the antero-posterior projection with the posterior part of the head down is proposed as an index of the size of the cerebral ventricles.

The average value of the ratio for a "normal" group was found to be 0·23, with extreme values of 0·16 and 0·29. There is a significant correlation between the size of the ventricles and the size of the skull, and the ratio has the same average value for small and large skulls and for the skulls of infants, children and adults.

The great majority of normal values fall between 0·20 and 0·25; values above 0·30 indicate definite ventricular enlargement, and provide a quantitative estimation of the degree of cerebral atrophy.

Serial studies may give an indication of the course of the brain lesion and a basis for prognosis.

(Author's abstr.)

Familial Mental Deficiency Akin to Amaurotic Idiocy and Gargoylism.

Six cases of an apparently new type of familial mental deficiency are described. The clinical features consist of severe idiocy, stunted growth, characteristic facies and peculiar changes in the bones of the skull. Pathologically there is ubiquitous swelling of the nerve cells with cytoplasmic infiltration of lipoid granules.

The relation of this condition to juvenile amaurotic idiocy and gargoylism is discussed. Differences are indicated which appear to justify a separation of this type of mental deficiency. It is pointed out, however, that amaurotic idiocy, gargoylism and the condition in the cases here reported show obvious similarities which warrant their inclusion in the same group of diseases.

The pathogenesis of this condition is discussed, the morbid process being considered an instance of localized lipoidosis. From the etiologic aspect, the disease is considered to be genetically determined, and probably inherited as a recessive. (Author's abstr.)

Alternating Tremor and its Relation to Cortical Pathways.

A case is reported of bilateral paralysis agitans which had been present for twelve years when thrombosis of the right middle cerebral artery developed, with resulting left spastic hemiplegia, from which the patient recovered during the next three years with about 60 per cent. of voluntary motor power. The tremor (of paralysis agitans) never returned to the affected extremities, however. The rigidity, previously present, was not altered. Post-mortem examination revealed complete destruction of the head of the caudate nucleus, the putamen, part of the globus pallidus and portions of the internal capsule. Three-fifths of the pyramidal tract, the whole frontopontile system and a part of the temporopontile system, the frontothalamic fibers to the anterior lateral thalamic nucleus, the corticorubral and the corticonigral fibers were affected. (Author's abstr.)

Disturbances in Brain Function following Convulsive Shock Therapy.

A series of 23 patients with affective reactions treated with metrazol induced and electrically induced convulsions were studied clinically and electroencephalographically to determine the presence and extent of post-therapeutic disturbances in cerebral function.

Of 23 patients, 14 recovered or improved and 9 did not improve. Early recurrences were included in the category of no improvement. In contrast to previous forms of treatment the striking feature was the spectacular rapidity of recovery of the patients who were cured.

Evidence of disturbed cerebral function was present in 50 per cent. of the patients as indicated by changes in the electroencephalogram and in 45 per cent. of the patients as shown by changes in intellectual function.

In the most severely affected patients epileptoid disturbances in the electroencephalogram

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developed, consisting of three per second waves, bicuspid and dierotic waves, spike and wave formations and greatly increased amplitude. The post-therapeutic clinical evidences of impaired cerebral function consisted of an " organic " type of sensorial and intellectual impairment.

Recovery from these disturbances of cerebral function occurred in most patients in a few weeks. In the more severely affected patients evidences of impaired cerebral function sometimes lasted as long as six months.

Recovery or improvement is apparently not dependent on the presence of such changes in cerebral function as are shown by our methods of electroencephalographic examination and tests for mental status. (Authors' abstr.)

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Central Autonomic Paralysis.

The cases of six patients with lesions of the brain stem due to vascular thrombosis are described. Five of the six patients had a more or less typical lateral medullary syndrome due to occlusion of the posterior inferior cerebellar artery. The lesion in the sixth patient was probably due to thrombosis of a lateral branch of the superior cerebellar artery.

In four cases there were minimal evidences of Horner's syndrome or sweating disturbances. In the two cases reported in detail sweating on heating the body and vasoconstriction on cooling the body were seriously disturbed, but vasodilatation on heating the body and vasoconstriction from a full inspiration or from sensory stimuli were normal.

This study indicates that the efferent tracts concerned with various functions of the autonomic nervous system are at least in part anatomically distinct in the medulla, so that a lesion may destroy the tracts concerned with one or more functions of the autonomic system without interfering with the remainder.

Central lesions of the autonomic nervous system produce signs that are different from those caused by the removal of the sympathetic ganglia or nerves, just as lesions in the sensory cortex produce signs that differ from those caused by sectioning a peripheral nerve or the posterior roots. (Authors' abstr.)

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Metastatic Tumors of the Brain.

The clinical manifestations and the anatomic observations in 57 cases of metastatic tumor of the brain are analyzed.

(A) On the clinical side, observations on the evolution of the symptoms and signs in cases of metastatic tumor of the brain point to the following conclusions:

The onset of cerebral manifestations is most commonly acute and often precipitate, with symptoms of increased intracranial tension, such as headache, nausea and vomiting. These symptoms, appearing early in the disease, manifest themselves in an intensity out of proportion to the then present meager objective neurologic signs.

Papilledema is absent in a large number of instances (34 cases, or 59·6 per cent. in this series); moderate in some (16 cases, or 28 per cent.), and pronounced only in a few (7 cases, or 12 per cent.).

The presence or absence of meningeal signs does not seem to bear any relation to the position of the tumor in the brain.

Mental alterations are found in a somewhat greater number of cases of metastatic than of primary tumor of the brain (23 cases in this series).

The evolution of the clinical course is characterized by a rapid transition from the early stage, in which the cerebral signs are few and vague, to a stage in which manifestations of an existing focal lesion of the brain are prominent. In a large number of instances these may be of a disseminated character, and in an equal number of instances they may point to the presence of a single circumscribed process. The rapid unfolding of the clinical picture is marked by an equally rapid decline in the general condition of the patient.

The laboratory investigations pertaining to the cerebro-spinal fluid contribute little to the diagnosis. While the cell count of the cerebro-spinal fluid at times may be above normal, or even very high, tumor cells are rarely discovered in the fluid. The increase in the globulin and the slight increase in the sugar content of the cerebrospinal fluid noted in a few cases are not pathognomonic of metastasis.

Thus, it may be said that an acute onset of symptoms of increased intracranial tension, such as headache and vomiting, followed by rapidly progressive development of neurologic signs of either disseminated or more localized character, accompanied by slow development of papilledema in the absence of positive serologic reactions and febrile manifestations, points strongly to an expanding lesion of a metastatic character. Such a suspicion demands search for a primary lesion by all available clinical and laboratory methods, since the therapeutic indications depend on recognition of the character of the neoplastic process.

In some instances the knowledge thus obtained may point to the advisability of intracranial surgical intervention, with promise in some instances of temporary relief from the more disabling and painful symptoms and prolongation of life, and in rare instances still better results. Surgical treatment was attempted in a limited number of cases in this series. In some cases this was done because the metastatic character of the lesion was not recognized. The result of successful removal of the tumor somewhat lengthened life with comfort beyond the probable life expectancy.

(B) The anatomic features may be summarized as follows:

In the larger number of cases (52·6 per cent. of the total series) multiple tumors, variable in

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size and distribution, were revealed, while in a somewhat smaller group (38·6 per cent.) the metastatic lesion was single and massive. Finally, there was a third, very small, group, constituting 8·8 per cent. of the total number, characterized by diffuse, microscopic infiltrations. The great majority of the tumors in this series were observed in the brain substance. Only in one case was the lesion restricted to the dura, and in one case to the leptomeninges.

In 49 of the 57 cases the metastatic lesion was in the nature of a carcinoma, leaving only eight cases to be distributed among tumors of other types; the Grawitz tumor (two cases) and neuroblastoma, lymphosarcoma, spindle-cell sarcoma, melanosarcoma, chorionepithelioma and Ewing's sarcoma (one case each). This observation seems to indicate that in the predominant number of instances the primary focus is most likely in some part of the respiratory or gastro-intestinal tract and serves to direct the search for a suspected primary seat of the disease to these two systems.

In all of the cases in which full post-mortem examination was made metastasis to the brain was found to be but an expression of a generalized process of dissemination, as other viscera were coincident sites of the metastases. The lungs, when not the primary seat of the malignant growth, were spared of recognizable metastatic lesions in only six cases. Of 23 cases in which autopsy was restricted to the brain, roentgen studies suggested the presence of metastases in the lungs in seven cases. This observation also serves as a guide in distinguishing between the primary and the secondary character of an intracranial neoplasm, and points to the need for a clinical investigation in almost every instance of brain tumor by every available method (gastric analysis and roentgenographic and pyelographic studies) in order to establish a probable source of metastasis.

Our material presents strong evidence that the metastatic cells are brought to the brain by the blood stream and no evidence of transportation of neoplastic cells to the brain by true lymphatics.

The growth of the metastatic tumor in the brain takes place at the expense of adjacent brain tissue. Its extension is by way of the perivascular spaces and probably also by actual transportation of small cell groups through the vascular channels.

In spite of its invasive character, a discrete line of demarcation between the metastatic tumor and the adjacent tissue is maintained, and only mild reactive changes, such as a narrow zone of condensation, gliosis and occasional lymphocytic infiltration in nearby brain tissue, are present. In rare instances a narrow belt of hemorrhage is observed, and this is particularly true of metastases from the so-called Grawitz type of tumor, or hypernephroma. Relatively wide areas of oedema of surrounding brain tissue are common.

The tumor tissue itself is usually rich in blood vessels, occasionally shows extravasation, but most frequently contains relatively large areas of necrobiosis. A fairly large number of such tumors contain cysts filled with gelatinous material. In a small group of cases of metastatic invasion of the brain the lesions are widespread in distribution but are restricted to infiltrations about blood vessels. These lesions are recognized only microscopically and are occasionally described as miliary carcinomas.

The choroid plexus, which was studied with a view to determining its role in the transportation of tumor cells to the nervous system, was the seat of metastatic invasion in only 1 of 57 cases. (Authors' abstr.)

Pathology of Senile Brains: (1) *Silver-reducing Structures in the Hippocampus.*

The present communication is devoted to the study of the hippocampal formation in senile brains. The characteristic pathologic change is the presence of intracellular and extracellular substance or substances capable of reducing ammoniacal silver solutions without further chemical treatment. The staining method employed in the present study differs from the usual histologic methods in clearly differentiating such material from technical artefacts and from silver deposits of unknown nature, as well as from normal tissue constituents. The Alzheimer fibrillary change is a generic name for various types of intracellular alteration, all of which have in common this property of a reducing substance. The Alzheimer change represents at least two different processes, in one of which the reducing substance is associated with neurofibrils and in the other of which it is not so associated.

Several types of each process are illustrated and described. Special interest is centred on the pyriform cells in the pyramidal layer, in which the fibrils are sometimes of extreme delicacy, even though the cells may be undergoing dissolution. Pericellular argyrophilic structures, in intimate relation to many pyriform cells, are described. Some of this pericellular material is indistinguishable from that form of senile plaque known as the fine-fibered, hairlike type. Examples of transitional stages between pyriform cells and fine-fibered plaques are described, but these form only a small proportion of all plaques. No transition between any other type of plaque and any other type of cell change has been observed. Glia cells do not form or elaborate the material constituting senile plaques. Other types of silver-reducing substances observed in senile brains include short stretches of nerve and glial fibers, often in small groups and clusters; corpora amylacea; granulovacuolar degeneration of neurons, an argyrophilic change in blood-vessel walls and an intraepithelial network of fibers in ependymal cells. The interrelation of different types of pathologic silver-reducing substances is briefly discussed.

(Author's abstr.)

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Pathologic Anatomy of Human Nervous System in Avitaminosis.

The literature dealing with neuropathologic studies on both human and experimental deficiency of vitamin B_1 and the P-P factor is reviewed.

An endemic of so-called secondary B complex avitaminosis was encountered in a group of 13 Chinese soldiers who had suffered primarily from dysentery and tuberculosis. Besides an inadequate supply, the factors of poor absorption and an excessive loss of the vitamins also played an important role in the production of avitaminosis in these patients.

The diagnosis of beriberi and pellagra was based on the demonstration of a uniform, characteristic neuropathologic picture.

The possible histopathogenesis of the outstanding individual nerve lesions is discussed.

The neuropathologic process was degenerative and involved both the sensorimotor and the autonomic nervous system.

The neuropathy of the peripheral nerves was the anatomic substratum of beriberi, while primary irritation of the Betz cells was a constant morphologic manifestation in pellagra.

The neuropathologic process tended to proceed centripetally in beriberi and centrifugally in pellagra.

The involvement of the peripheral nerve trunks and the nerve roots was predominantly confined to the sensory fibers, their distal portions being more severely damaged than their proximal portions.

The lesions of the spinal cord were characterized by frequent sclerosis of the posterior columns, especially the fasciculus gracilis, and occasional involvement of the pyramidal and the lateral sensory tracts.

The degeneration of the ascending fibers of the spinal cord was chiefly of Wallerian type secondary to a neuropathy of the posterior nerve roots. There was, however, evidence to suggest an independent process. Therefore the spinal funicular disease in the present cases was not exactly systemic.

The frequency of the funicular involvement was apparently related to the duration and the severity of the deficiency.

A typical cutaneous lesion of pellagra was noted in one case.

The exact mode by which the vitamins act on the nerve tissue is not known. A mere morphologic approach seemed to be futile in any attempt to solve this problem.

Further neuropathologic studies on human beriberi and pellagra should include a study of the neuromuscular end organ and the glycogen content, the mitochondria and the oxidase reaction (Dutcher) of the nerve cells in selected cases.

A careful neuropsychiatric examination is indicated in cases of disturbance of the gastrointestinal tract.

No pathologic examination in cases of lesions of the gastrointestinal tract is considered satisfactory without an adequate study of the nerve tissue.

It is necessary to supply adequate vitamins in cases of gastrointestinal trouble, especially by the parenteral route, even though no frank signs of neuropsychiatric disorder can be detected clinically. (Author's abstr.)

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The Relation of Various Hypothalmic Lesions to Adiposity in the Rat.

Obesity is not produced in rats by lesions which destroy (1) the fornix bilaterally with small damage to surrounding tissue in the anterior hypothalmus; (2) large portions of the caudal halves of the anterior hypothalmic areas symmetrically; (3) most of the mammillary body; (4) most of one side of the hypothalamus; (5) the midline structures in and close to the floor of the third ventricle, including the median eminence, and the arcuate and suprachiasmatic nuclei.

Obesity can be produced by fairly symmetrical lesions which destroy bilaterally (1) most of the ventromedial hypothalamic nuclei together with some of the tissue immediately around them, especially on their lateral sides; (2) the caudal ends of the ventromedial hypothalamic nuclei, the premammillary area, and a considerable part of the lateral hypothalamic areas adjacent to it; (3) in the caudal hypothalamus the areas which lie dorsolateral to the mammillary body. These pairs of lesions appear merely to represent interruptions at successive levels of paired systems (one on each side of the hypothalamus, and each one capable of acting more or less independently).

The systems in question seem to arise rostrally in, or in the neighbourhood of, the ventromedial hypothalamic nucleus, and to proceed caudally into the midbrain in the company of the medial forebrain bundle. The descending pathway may of course consist of chains of short neurons.

Ordinarily, adiposity in male rats is associated with some degree of stunting, in respect to body length, but the same is not true of females. It has also been found that adiposity caused by hypothalamic lesions lying caudal to the infundibulum is not usually accompanied by persistent vaginal estrus in the female. There likewise appears to be no significant correlation between the occurrence of adiposity and diabetes insipidus, the lesions which cause them being apparently fundamentally different.

The hypophyses of the obese rats which have been examined are in most cases quite clear of involvement in the destruction at the base of the brain. (Authors' abstr.)

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IQ Correlated with EQ.

715 children at a mental hygiene clinic were examined with the Stanford-Binet and the New Stanford Achievement Test and IQs and EQs obtained. "The correlation obtained on the whole (group) . . . does not differ from correlations obtained in groups described by other persons. However, when it is broken down in diagnostic groups there appears to be a negative correlation among the mental defectives, persons of borderline intelligence and persons of dull normal intelligence, a slight correlation among persons having high normal general intelligence, and a substantial correlation among the persons having normal and superior general intelligence. Significant differences were found between the mean performances of males and females on both intelligence and educational tests. . . . There appears to be a perceptible rise in correlation with the rise of IQ, although the high normals are an exception to this. From the evidence on hand the EQ cannot be substituted for the IQ."

J. W. MACMILAN (Psychol. Abstr.).

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Some Electroencephalographic Correlates of Intelligence in Eight-year and Twelve-year-old Children.

(1) The relationship between occipital area alpha frequency, alpha index, and intelligence level has been investigated in a sample of forty-eight eight-year-old children especially selected to represent a wide range of intelligence levels. The relationship between occipital and motor area alpha frequency and intelligence level has been investigated in a sample of 42 twelve-year-old children similarly selected but having a slightly narrower range of intelligence levels.

(2) At the eight-year level the correlation between alpha frequency and intelligence level was + ·50; that between alpha index and intelligence level was + ·23. Only the first of these is statistically significant.

(3) At the twelve-year level the correlations between occipital alpha frequency, motor alpha frequency, and intelligence level were + ·12 and — ·08 respectively. Neither of these is statistically significant.

(4) Three hypotheses have been suggested to account for the conflicting results. The first two suggest that sampling error may be equally responsible for the "significant" and the "non-significant" correlations. The third suggests that at the twelve-year level organic changes associated with adolescence may alter an otherwise significant positive correlation.

(5) These hypotheses may be tested by further research; and it is to be urgently suggested that any present conclusions regarding the relationship of EEG variables and intelligence level be regarded as tentative until full exploration and attendant confirmation or rejection of these hypotheses be accomplished. (Authors' abstr.)

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An Eye Dominance Gage and Some of its Uses. *Diehl, H. T.* 181

Mental Efficiency Levels before and after Shock Therapy.

496 mental hospital patients were tested before and after shock therapy (insulin, metrazol, or a combination of both), with information and memory tests; attitude ratings and test reactions were also secured. The average scores of all groups improved after therapy on the several functions studied. The data are analyzed in terms of the percentage of each group showing improvement and still showing improvement a year later. The percentage of cases improved was higher for the metrazol and insulin groups than for the mixed therapy groups. Data on improvement for each psychosis are presented. Various inter-relationships of the data, such as test intercorrelations and psychiatric versus test ratings of improvement, are discussed. The attitude of the patient after therapy is perhaps the most significant change, probably being much involved in the improvement in test scores. Duration of psychosis was found to be related to this improvement. Cases showing lower test scores after than before therapy also showed a decline in attitude rating. C. N. COFER (Psychol. Abstr.).

The Intelligence of the Narcotic Drug Addict.

The Wechsler-Bellevue intelligence scale was administered to 371 native, white, male narcotic drug (opium or derivatives) addicts who had experienced drug withdrawal and recovery from physical dependence and were ready for occupational assignment. Most of the addicts were in the average or superior intelligence groups, although some were found over the whole range. There was no suggestion of an abnormal decline with age and no discrepancy between verbal and performance scores. Matched addict and attendant groups did not differ significantly in scores on the sub-tests of the scale. Volunteer patients were slightly superior to prisoner patients in total and verbal IQ. C. N. COFER (Psychol. Abstr.).

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*The Treatment of " Metrazol Failures " with Insulin. *Weinberg, J., and Goldstein, H. H.* 597

The Neuromuscular Hypertension.

It is concluded that a systematic investigation of the muscle sense in nervous persons reveals that patients differ widely from each other in that respect. Further, it helps in detecting tonically fixed or hyperactive muscle groups, so enabling the clinician to attain a direct understanding of pains and fatigue in patients, whose symptoms might otherwise have been described as subjective. The therapeutic technique, aiming at relaxation, will have the effect of bringing forth information which extends and differentiates the anamnesis. The text includes two illustrative cases. S. M. COLEMAN.

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Diagnosis of Convulsions in Brain Tumors.

In 14 cases of verified brain tumour, under observation for several years, convulsive phenomena were the only objective symptoms. The epileptoid manifestations presented special characteristics in onset, in distribution, in the accompanying signs, in the mutual relationship of the latter, in the manifestations following the motor phenomena, in the mutual relationship of motor and subjective sensory disorders before, during and after the seizure. The above enumerated features of epileptic convulsions appear to be sufficiently characteristic for the diagnosis of brain tumour in the very early stages of the disease. S. M. COLEMAN.

Neurological Aspects of Simple Mastoiditis.

112 patients with uncomplicated mastoiditis were reviewed. Neurological signs and symptoms were carefully looked for and only a few patients presented pathological involvement. Lumbar puncture findings were recorded in 74 patients and only a few had abnormal spinal fluid. These negative findings are in sharp contrast to the observations of Nielson and Courville in a seemingly comparable series of patients. S. M. COLEMAN.

Prognosis in Paranoid Disorders.

Evidence is brought forward to show that the prognosis in paranoid disorders is not so uniformly bad as was formerly believed. Of 290 cases, 72, or almost a quarter, had a relatively good outcome. There is a careful analysis of the factors which the recovered patients appeared to have in common. S. M. COLEMAN.

Psychotic Manifestations in Encephalitis.

Five patients suffering from chronic encephalitis and showing psychotic manifestations are described. The authors do not advocate hospitalization for all cases, yet they feel that generally those cases who show asocial or anti-social behaviour disorders with or without psychotic manifestations should be confined to institutions. This should be done for the good of the patient as well as for the family and community. S. M. COLEMAN.

Treatment of "Metrazol Failures" with Insulin.

100 patients were treated with insulin following their failure to respond to metrazol treatment. Out of these, 32 showed good improvement, 37 showed some improvement, and 30 failed to respond. Of patients ill more than 18 months, there were 64; only 12 responded favourably. S. M. COLEMAN.

VOL. XCV. JUNE, 1942.

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The Pyramidal Tract. *Lassek, A. M.* 721
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Cerebrospinal Fluid in Dementia Praecox.

In 1,281 dementia praecox patients (new and old cases) an increase of the spinal fluid protein, ranging between 46 and 166 mgm. per cent. c.c., was found in 5·0 per cent. of the male and in 3·2 per cent. of the female patients. In only four instances was the protein over 100 mgm. In the remaining cases the total protein varied between 46 and 99 mgm. A few of the schizophrenic patients with an increased fluid protein had a parentage suspicious of syphilis. In most patients the pathological spinal fluid findings could not be explained. S. M. COLEMAN.

Ataxia and Charcot-Marie-Tooth Atrophy.

Two brothers are described, each exhibiting a combination of Friedreich's ataxia and Charcot-Marie-Tooth's muscular atrophy. One sister has Friedreich's ataxia and one cousin a spastic paraplegia. The interweaving of patterns in certain of the heredodegenerative diseases is illustrated, notably the Friedreich's complex, Charcot-Marie-Tooth disease, Roussy-Lévy syndrome and the familial spastic paraplegias. There is transmitted in some families a common genetic vulnerability of certain tracts in the nervous system, the degeneration of which may occur in simple or in complex fashion and produce mild or complicated neurological disorder. S. M. COLEMAN.

Non-Organic Epilepsy.

63 out-patients with non-organic epilepsy, 49 of whom were on bromides for periods ranging from six months to five years with blood bromides of 75 to 250 mgm./c.c. serum, 9 on luminal, and 5 on no sedative, were tested with the Stanford-Binet intelligence test at intervals of one to three years. Each patient was tested from two to four times, and the interval between the

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first and final tests ranged from one to seven years. Under these conditions bromides have no deteriorating effects, since there was no change in the intelligence quotients associated either with the amount or the length of the bromide treatment. The number of patients on luminal was not large enough for definite conclusions, although the data agree with other experimental results that luminal causes no deterioration. Eight patients showed significant increases of the intelligence quotients between the first and final tests, and seven patients showed significant decreases. Some of these changes must be accounted for on the basis of chance fluctuations which are characteristic of the epileptic. If only progressive changes of the intelligence quotients are taken as indicating a real trend in the direction of improvement or deterioration, then only one patient (1·6 per cent.) improved and three patients (4·8 per cent.) deteriorated. There appears to be no relation between the reduction in the number or severity of the fits and the changes of the intelligence quotients. S. M. COLEMAN.

Electro-therapy in Schizophrenia.

Ten patients were treated and they received an aggregate of 174 treatments (86 convulsions, the remainder subconvulsive). Only two of the cases were recent admissions; nine showed moderate to slight improvement, one showed no improvement. Beyond a dislocation of the jaw there were no complications. S. M. COLEMAN.

Aphasia with Brain Tumours.

The initial symptoms of aphasia in cases of brain tumours are likely to take the form of difficulty in word-finding. Investigation of the subject of amnesic aphasia and a review of the literature show that fundamental problems are still unsolved. It appears that amnesic aphasia represents a mild disturbance affecting the association functions of language. There is clinical evidence that two regions of the brain, namely, Broca's area and the zone adjacent to the sensory centre for sound in the temporal lobe of the dominant cerebral hemisphere, are particularly involved in this disorder. Both regions may be part of a more extensive common language area about the fissure of Sylvius. S. M. COLEMAN.

Anancastic Depressions.

Clinical observations on 16 patients with obsessive-compulsive symptoms occurring in a setting of depression are reported, two representative cases being used for illustration.

The personality previous to the onset of the present illness was that of a rigid, anancastic individual. The clinical characteristics of these anancastic depressions are discussed, and special problems associated with management, course and treatment elucidated.

S. M. COLEMAN.

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The Catatonic Pupil.

The catatonic pupil is a frequent finding in psychotic patients, and is characterized by inequality of size, inconstancy in reaction, and sluggishness or complete abolition of the light reflex. The theory is advanced that the catatonic pupil is due to an imbalance of the sympathetic-parasympathetic system as the result of inhibition of the parasympathetic. The catatonic features may represent an intermediate stage before complete fixation of the pupil occurs.

S. M. COLEMAN.

Psychiatry and Culture.

In this paper the writer surveys the contributions of psychiatry to the world of science, literature and art. S. M. COLEMAN.

Deterioration in Organic Epilepsy.

Twenty-seven out-patients suffering from organic epilepsy were tested with the Stanford-Binet intelligence test at intervals from one to nine years, with two to five tests on each patient. The number of years between the first and final tests ranged fron one to ten years.

Considered as a group, there was definite deterioration with an average decrease of 6·0 I.Q. points between the first and last tests. These patients as a group differed from patients with non-organic epilepsy in that their initial intelligence scores were lower than those of the non-organic group.. There appears to be no difference as to the degree of deterioration associated with different organic aetiological factors for the epilepsy. In 11 per cent. of the cases there was a significant increase of the intelligence scores, and in 37 per cent. a decrease, as compared to 5 or 6 per cent. in idiopathic epilepsy (see previous paper). S. M. COLEMAN.

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Electrostimulated Convulsive Doses.

A method and apparatus for delivering various types of unidirectional electrical stimulation are described together with a method for estimating the amounts of current at the time of administration. S. M. COLEMAN.

J. NEUR. AND PSYCHIATRY.

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Lissauer's Dementia Paralytica.

The evidence supports the original view of Lissauer and Alzheimer that the circumscribed lesions are essentially due to a local intensification of the paretic process. It demonstrates that the absence of apoplectiform or epileptic convulsions on the clinical side, and of macroscopic atrophy and status spongiosus from the pathological aspect, do not necessarily exclude a diagnosis of Lissauer's dementia paralytica. (Authors' abstr.)

Chemical Changes in the Blood and the Occurrence of Uraemia Following Head Injury.

It is shown that plasma inorganic phosphate is raised in severe cerebral lesions, and that in a few cases uraemia follows rapidly on cerebral injury. Such patients show raised blood urea and phosphate levels with a normal volume of urine, but with a high excretion of urea in an acid urine. Alkalis caused a clinical improvement in one patient with a raised blood urea. Alterations in chemical content of phosphate and uric acid were found in the kidneys from two of the patients who died of uraemia. (Author's abstr.)

Electro-encephalographic Studies of Psychopathic Personalities.

Forty-eight per cent. of 151 psychopathic personalities have abnormal EEGs. Fifteen per cent. of 52 normal controls had abnormal EEGs. Sixty-five per cent. of 66 aggressive psychopaths have abnormal EEGs. The more aggressive the patient the more likely is the EEG to be positive. Thirty-two per cent. of 38 inadequate psychopaths have abnormal EEGs. Where epilepsy is associated with aggressive psychopathy, the percentage abnormal is probably much higher (82 per cent.).

Delinquency alone does not appear to be associated with an abnormal EEG. Among inadequate psychopaths, head injury may account for a percentage of EEG abnormality; there is no evidence that it is responsible to the same degree among aggressive psychopaths. Examination of family histories shows that aggressive bad temper is found nearly three times as frequently among the first-degree relatives of aggressive psychopaths as among those of the inadequate group. Epilepsy is not found to the same extent. The presence of epileptoid conditions in the parents and siblings does not increase the chance of an abnormal EEG in either group of patients. (Authors' abstr.)

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Impedance Changes in Frog's Muscle Associated with Electrotonic and "Endplate" Potentials.

1. Transverse impedance measurements are made, during direct and nerve stimulation, on the isolated sartorius muscle of the frog.

2. The electric impedance of the muscle is altered at anode and cathode, following the application of a brief subthreshold current pulse. There is an impedance loss at the cathode, and a smaller impedance increase at the anode.

3. These changes decline slowly after the applied current pulse has disappeared. The time course of decay is approximately the same as that of the endplate potential of muscle.

4. With threshold currents, propagated spikes start at the cathode at a moment when the impedance loss reaches its peak.

5. Impedance changes set up by a nerve volley are recorded at the junctional region of the frog's sartorius. The propagated spike in normal muscle, and the endplate potential (e.p.p.) in completely curarized muscle are both accompanied by an impedance decrease. Measuring with alternating current of 5,000 c.p.s., the overall impedance loss during the spike potential (60 mV) amounts to about 10 per cent., that during the e.p.p. (2–3 mV) to only 0·1 per cent.

6. The impedance change in completely curarized muscle has the same latency and lasts as long as the e.p.p. The rising period of the impedance change is shorter (slightly more than half), and its initial fall more rapid than that of the e.p.p.; during the later phase of decay the time course of the impedance change is identical with that of the e.p.p.

7. The prolonged phase of the impedance loss during the e.p.p. is analogous to that produced at the cathode by a direct subthreshold current pulse. The rapid phase of impedance change which occurs during the building-up period of the e.p.p. is discussed in relation to the problem of neuro-muscular transmission. (Author's abstr.)

Some Physiological Aspects of Audiogenic Seizures in Rats.

Electroencephalographic and heart-rate changes have been studied in rats during stimulation with high-pitched tones which produced seizures and other abnormal behavioral manifestations. Seizures occurred in approximately one-half of the unrestrained rats, but no attacks were induced in restrained, curarized or vagotomized animals. Various phases of an audiogenic attack were associated with abnormalities of the EEG similar to those observed in epileptics during an attack; in non-seizure stimulation trials the EEG and heart rate changes were not noted, except in unrestrained animals, where it was noted that heart-rate changes were frequently accompanied by some form of "substitute behavior." Following the onset of stimulation but prior to an attack marked increases and/or decreases in heart-rate occurred; these were interpreted as evidence of dual action of the autonomic system preceding audiogenic attacks, in which both sympathetic and parasympathetic systems participated, but with the former tending to predominate.

On the basis of the results an attempt has been made to outline the temporal course of physiological events leading to the development of an audiogenic seizure. (Authors' abstr.)

Responses during Refractory Period at Myoneural Junction in Isolated Nerve-muscle Fibre Preparation.

Electrical responses set up by a nerve impulse at the junctional region during the refractory period have been investigated in the single nerve-muscle fibre preparation of the M. adductor longus of frog (*Hyla aurea*).

1. Three types of responses can be recorded at the junctional region during refractoriness: (*a*) an endplate potential (e.p.p.); (*b*) "abortive" impulses (local responses); (*c*) fully propagated impulses.

2. During the slow propagation of an impulse away from the endplate zone in the refractory muscle the impulse may either "grow up" to its full size and speed, or die out (abortive impulses). The dying out and the "growing up" process occurs over 1 or 2 mm., according as the conditioning muscle impulse is set up by a nerve impulse or by direct stimulation. The abortive impulses may attain about 30 per cent. of the full spike potential height.

3. The e.p.p. set up by a conditioning nerve impulse lengthens the muscle refractory period.

4. The effect of the e.p.p. in setting up muscle impulses and in modifying their spread from the myoneural region is discussed. (Author's abstr.)

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Effects of Eserine on Neuromuscular Transmission.

Both in cat's and frog's muscles eserine increases and lengthens the local negative potential change (the endplate potential, e.p.p.) set up by one or more nerve volleys at the myoneural junction.

In addition, repetitive nerve volleys produce a delayed "slow wave" (height up to 40 per cent. of spike, duration up to several seconds) at the junctional region of eserinized muscle. The onset of the slow wave merges more or less with the decaying phase of the e.p.p.

Curare antagonizes the eserine effect: it greatly reduces the slow wave component and shortens and diminishes the e.p.p. Even in fully curarized muscle eserine causes a prolongation of the e.p.p.; the rising phase is lengthened up to threefold, the e.p.p. thus building up to a greater height. Both in normal and curarized muscle increase of eserine beyond a certain high concentration (about 3 by 10^{-5} in the frog) causes no further prolongation of the negative potentials, and actually diminishes their size.

The junctional potentials of eserinized muscle give the typical effects of an increased and prolonged catelectrotonus: (i) repetitive muscle spikes, when above threshold size; and (ii) lengthening of refractory period, and, during very intense depolarization, a complete block of impulse propagation.

The production of nerve after-discharge in the eserinized cat has been further investigated. Repetitive muscle impulses can arise from the junctional potentials independently of nerve after-discharge. In the cat, during prolonged eserine potentials, retrograde propagation of impulses from muscle to nerve was observed.

The principal effect of eserine is a lengthening of the action of the neuromuscular transmitter, thus leading to prolonged junctional negativity with consequent catelectrotonic effects.

In an attempted analysis of the curare-eserine antagonism it is shown that (i) curare does not antagonize the inhibition of cholinesterase by eserine; (ii) curare has little or no effect in quickening the adaption of muscle to acetylcholine.

By making plausible assumptions it is shown that the observed curare and eserine actions are reconcilable with the hypothesis that ACh is responsible for all the local potential changes set up by nerve impulses. (Authors' abstr.)

Excitability of Cerebral Cortex in Infant Macaca mulatta.

The cerebral cortex of the three-week-old (infant) *Macaca mulatta*, when stimulated electrically, produces movement contralaterally.

The stimulable motor foci are confined to area 4, and no responses are elicitable from area 6 or the post-central convolution.

Facilitation and extinction of motor response are easily demonstrable. Relatively high voltages are required to elicit responses and these, like the spontaneous motions, are less discrete and slower in onset, execution and cessation than those of the adult. This may indicate either higher threshold in an as yet undeveloped cortex or less adequate corticospinal conduction.

Responses are more easily elicited in the face, less in the hand, and not at all in the leg.

Lack of response from area 6 is correlated with the forceful, sustained and easily elicited forced grasping normal for that age.

That suppression of motor response is elicitable from 8 and 4's at this age when removal of 4's does not yet produce spasticity suggests the functional immaturity of that structure whose unsuppressed activity would give rise to spasticity in older animals. (Authors' abstr.)

Effects of Presynaptic Volleys on Spread of Impulses over the Soma of the Motoneuron.

A centripetal volley of impulses which arrives at the spinal cord over ventral root fibers of cats and rabbits produces a series of potential changes in the ventral horn. A brief initial positive potential-change signals the approach of the impulses in ventral root axons. A negative deflection of a duration of 1–2 msec. follows. It is due to the invasion of the motoneuron soma (cell body and dendrites) by the centripetal impulses. The negativity passes over into a much more prolonged and smaller positive phase. A rapid series of essentially identical centripetal volleys evokes negative deflections of diminishing size. It is concluded that the response of the motoneuron soma is modified by frequencies of stimulation (e.g. 300 per sec.) which the motor axons follow readily. These observations on spinal motoneurons confirm Lorente de Nó's findings for cranial motoneurons.

Conditioning dorsal root volleys alter the motoneuron soma response to centripetal testing volleys in motor axons. The negative potential-change in the ventral horn due to the motoneuron somas is increased, or as the case may be, depressed. The result depends upon the conditioning dorsal root fibers, the tested motoneurons and the interval between the arrival at the cord of the conditioning and the testing volleys.

It is concluded that retrograde conduction in the motoneurons occurs with a decrement. The degree of penetration into the cell body and dendrites can be augmented or decreased by the consequences of activity in sensory and premotor neurons. (Author's abstr.)

JULY.

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*Further Study on Transmission in an Isolated Nerve-muscle Fibre Preparation. *Kuffler, S. W.* 309

Positional Nystagmus in Cerebellar Lesions.

After lesion of parts of the cerebellum of cats, particularly of the lobus posterior medianus, nystagmus was observed in abnormal positions of the head, particularly in supine position with the vertex downward. A weak nystagmus in normal position of the head was increased, sometimes also its direction was changed, in abnormal positions; or nystagmus appeared in abnormal positions only. This phenomenon is transient. Electrolytic lesions of nuclei tecti had a similar effect. In analyzing the receptor mechanism, neck reflexes and retinal reflexes could be excluded. Bilateral labyrinthectomy abolished this effect of position, while a weak spontaneous nystagmus following cerebellar lesions is a phenomenon of release of parts of the vestibulo-ocular reflex arcs, since it is associated with increase of the experimental postrotatory nystagmus. The experiments suggest that the existence of positional nystagmus should routinely be tested in suspected cerebellar lesions. (Authors' abstr.)

Effects of Alkalosis and Acidosis on Cortical Electrical Activity and Blood Flow.

1. The minimal amount of acid (HCl) or alkali (Na_2CO_3) injected intravenously necessary to produce changes in the respiratory rate of the anesthetized cat does not disrupt the cortical potentials.

2. Changes in the electrical activity of the cortex following acidosis or alkalosis occur only if near-fatal amounts are injected or, in the case of alkalosis, if an abnormal pattern has already been established as in insulin hypoglycemia.

3. While intravenous injection of acid causes dilatation of the pial arteries in most cases and intravenous injection of alkali causes constriction in most cases, these changes are not obviously related to the alterations of cortical potentials. (Authors' abstr.)

A Deficiency in the Phrenic Respiratory Discharges Parallel to Retrograde Degeneration.

After section of the phrenic nerve the respiratory discharges recorded central to the cut undergo a temporary deficiency with a time course parallel to that described for retrograde degeneration in other neurons. Yet the phrenic cell bodies may show little or no anatomical change even when this deficiency is extreme. The deficiency is not due to failure of conduction in the phrenic axons. (Authors' abstr.)

Origin, Conduction and Termination of Impulses in the Dorsal Spino-cerebellar Tract of Cats.

By following the electrical responses set up in the dorsal spino-cerebellar tract of the cat, information has been obtained on the anatomy and physiology of the tract, on the synaptology of their cells of origin, presumably lying in Clarke's column, and on the activity which is initiated within the cerebellar cortex by impulses afferent to it in Flechsig's tract. Activity in the tract has been caused either by stimulation of the afferent fibers of peripheral nerves of the hind limb or by direct stimulation of the tract.

Flechsig's tract extends from the fourth lumbar level of the spinal cord into the vermis of the cerebellum. It is set into activity by impulses in the primary neurons of ipsilateral nerves which are afferent for muscle proprioceptors.

Impulses are conducted in Flechsig's tract nearly twice as rapidly as in the fasciculus gracilis. The greater conduction velocities in the tract are correlated with the presence of larger fibers.

Activity arises in Flechsig's tract after a delay of 0·5 to 0·9 msec. following the arrival of the primary impulses in the collaterals to Clarke's column. As a consequence of the greater conduction velocity in the tract, however, the delayed impulses overtake and pass the impulses which ascend in the fasciculus gracilis. They arrive at the medulla more than one millisecond earlier than the latter.

The responses of fibers of the tract are spikes lasting about 0·5 msec. To a single afferent volley the response is often a series of such spikes. The fibers are able to respond again within 2·0 msec. after the beginning of an earlier response. The response evoked on stimulation of one afferent pathway frequently is conditioned by activity resulting from stimulation of another afferent nerve. The conditioning effect may take the form of inhibition, or the afferent impulses may sum their excitatory effects. The electrical data indicate that the cells of origin of the fibers of the tract receive collaterals from more than one primary sensory neuron, and evidence also points to their activation by internuncial chains of varying degrees of complexity.

In the cerebellar cortex the fibers of Flechsig's tract are distributed to the lobolus centralis and to the adjacent folia of the culmen, principally on the same side, but with an overlap across the midline to the opposite side.

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Impulses which reach the cerebellar cortex via fibers of Flechsig's tract initiate considerable electrical activity in the cerebellum. Early components of the cerebellar response to all the afferent systems activated by a volley to the tibial or peroneal nerve have been identified as largely or entirely due to the mediation of impulses from Flechsig's tract. Another component has been shown to be produced independently of activity introduced via Flechsig's tract.
(Authors' abstr.)

Interference Factors in Delayed Response in Monkeys after Removal of Frontal Lobes.
After bilateral removal of the frontal association areas, monkeys succeeded in delayed response performance when darkness was maintained during the delay interval. Unlike normal animals, however, the operated animals failed when a bright light was turned on in the cage during the delay interval. The indirect method of delayed response was used throughout the experiment; that is, light, instead of food, was used as the cue stimulus.

These results make necessary the revision of previous hypotheses concerning the functions of the frontal association areas. The hypothesis is suggested that removal of the frontal association areas in primates leads to a marked impairment in their general capacities for memory, because the loss of these areas renders them more susceptible to retroactive inhibition.
(Author's abstr.)

Further Study on Transmission in an Isolated Nerve-muscle Fibre Preparation.
Experiments were carried out on isolated nerve-muscle fibre preparations from the M. adductor longus of the frog (*Hyla aurea*).

1. The transmitter action, i.e., the action of the depolarizing agent producing the endplate-potential (e.p.p.), has been further investigated in curarized and normal muscle. In normal muscle the intensity of the "active" depolarization decreases rapidly after about 2·5 msec., and has disappeared at about 5 msec. (18–20° C.). These durations are diminished by curarine.

2. During the greater part of the rising and falling phase of a propagating muscle impulse the membrane cannot be further depolarized, i.e., no appreciable additional potential can be added during that period by (i) an e.p.p., (ii) a sub- or superthreshold constant current pulse. It is therefore concluded that the polarizability of the muscle membrane is abolished during activity.

3. A propagating muscle impulse approaching the endplate region is speeded up by the e.p.p. in curarized or non-curarized muscle, in agreement with earlier work on the whole muscle.

4. The effects of subthreshold and superthreshold catelectrotonic potentials, produced by constant current pulses, are shown to resemble those due to the e.p.p. in normal and curarized muscle.

5. Local responses are set up in normal muscle when the stimulus is near threshold.

6. Some findings regarding multiple innervation of the muscle fibres in the M. adductor longus are described. (Author's abstr.)

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Pathological Nazi Stereotypes Found in Recent German Technical Journals. *Lerner, E.* 179
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Frustration Reactions of Normal and Neurotic Persons.

This study was designed to investigate the problem of the standardization of experimental conditions for producing and measuring frustration in children and adults. Ten adults and 48 children (18 of the latter diagnosed as neurotic) were used. The Freeman Puzzle Box, Kohs' Block Design Test, simple learning situations, and bright lights, loud noises and painful pinches were employed in such a manner as to produce frustration. EEG, respiration, P.G.R., pulse rate, etc., were measured, emotional stability and general overt activity rated, and the scores correlated. Whereas the individual physiological reactions did not show any difference between the two groups sufficiently large to justify diagnosis, the pattern of physiological reaction did. Among the more significant measures were percent. change in P.G.R. resistance, muscle tension as revealed by hand tremors, number of respiratory movements per minute, and dominance of the alpha rhythm. In spite of variations, these measures are more adequate in determining differences of emotional reactivity than overt activity or the evaluation of verbal material.

F. A. Mote, jun. (Psychol. Abstr.).

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The Role of Vitamins in Neuropathology.

In this discussion of the common problems of neuropathology and vitamin research the author reviews recent work on the normal distribution of B_1 and C in the nervous system, the nervous and mental symptoms of B_1 hypo- and avitaminosis, the possible connection of B_1 with immunizing and protective mechanisms in the nervous system (destruction of neurotropic viruses), and the relation of A to demyelinization. No definite connection has as yet been demonstrated between vitamin C deficiency and mental disease. M. E. Morse (Psychol. Abstr.).

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Treatment of Schizophrenia of Childhood.

This paper reports treatment methods employed, and an evaluation of results obtained, for 20 schizophrenic children with the onset of psychosis under the age of 12 (15 under the age of 10), who have been observed on the Children's Psychiatric Ward at Bellevue. Treatment has included socialization, shock therapy, and a variety of psychotherapeutic methods. The results are discouraging in comparison with other psychiatric disorders in children, but indicate that, if treated, many of these children have possibilities of further development. A detailed case-history is included to illustrate development. G. S. SPEER (Psychol. Abstr.).

OCCUP. PSYCHOL.

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Hyposensitivity to Foreign Protein in Schizophrenic Patients.

(1) The cutaneous responses to intradermal injections of guinea-pig serum, repeated weekly for 13 weeks, have been studied in a group of 12 schizophrenic male patients and in a group of 12 unselected male control subjects.

(2) In all patients and in all normal controls, a process of sensitization was developed by the successive injections.

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(3) It was found that the mean areas of maximum erythematous skin reaction of the patients to the successive injections were significantly less than those of the normal control subjects.

(4) One must distinguish between immediate and delayed skin reaction. The former indicates greater sensitivity. All control subjects had immediate reaction to the last four injections, whereas three patients did not have immediate reaction to any of the 13 injections.

(5) In order to determine whether the difference between patients and normal controls is due to a difference in their local vascular mechanisms or to their sensitivity to foreign proteins specifically, an intracutaneous injection of histamine was given to each patient. No positive correlation was found between the reaction to histamine and the reaction to guinea-pig serum. This finding suggests that the differences found between patients and control subjects are actually differences of immunological reactions.

(6) The hyposensitivity of the schizophrenic patients to foreign protein is a special manifestation of their general hyporeactivity.

(7) It is suggested that the comparison of immunological responses may be profitably used in the study of biological antagonism between various pathological conditions.

(Author's abstr.)

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The Validity of the Concept of Psychopathic Personality.

The concept of psychopathic personality is an ill-defined and very broad one. There is a strong tendency to use " psychopathic personality " as an exclusion diagnosis in those cases where a patient cannot be readily placed into the category of psychosis, neurosis or mental deficiency. This is particularly so if the patient has manifested striking anti-social behavior. A close analysis of the histories of 35 male patients diagnosed as " psychopathic personality without psychosis " reveals that the majority show a developmental picture which, psychodynamically considered, is that of a neurosis. This takes the form of a paraphiliac, alcoholic, hysterical or anxiety neurosis. In all these cases psychopathy represents the neurotic resolution of a personality conflict. Somewhat less numerous are those patients who are essentially schizoid or cyclothymic in make-up and show in their behavior the larval phases of a schizophrenic or manic-depressive psychosis. Least numerous are those individuals, not showing schizoid or cyclothymic coloring, in whom diligent search reveals little if anything of psychogenic significance with respect to their psychopathy. This last group is the only one to whom the term " psychopathic personality " can with some validity be applied. Case material in illustration of the above and a suggested narrower and more precise definition of " psychopathic personality " are discussed. (Author's abstr.)

Rigidity.

In normal behavior every performance is executed in " adequate " time. Shifts in performances are made as required by the task. Rigidity means abnormal fixation upon the performance in action and is frequently pathological.

We may distinguish primary and secondary rigidity.

Primary rigidity involves sequelae of an abnormality of the " Einstellung " mechanism, most frequently observed in lesions of the subcortical ganglia. The performance in action immediately becomes so rigid that responses to extraneous stimuli cease.

Secondary rigidity is due to a primary defect of the higher mental processes; in cortical

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damage and cortical malformations, such as feeble-mindedness. Only tasks beyond the individual's capabilities are affected. Feeble-minded children show rigidity when confronted by a task requiring the abstract attitude which in their cases is impaired.

The following theoretical interpretation will be offered : (1) Rigidity occurs when an organism is unable to come to terms with " its " environment in an " adequate " way. It is a means of protecting the individual from catastrophic conditions. (2) It is one type of reaction to a situation to which the individual is inadequate. Other types of reactions result in catastrophic conditions and distractability. Rigidity is a consequence of a mental deficiency, especially the impairment of the abstract attitude.

Normal individuals may also exhibit rigidity under certain conditions, namely, in performances beyond their scope. The implications of this theory for education of feeble-minded children will be discussed. (Author's abstr.)

The Structure of Agnostic Symptoms in a Case of Post-Traumatic Dementia.

A patient who showed agnostic symptoms as part of the picture of a post-traumatic dementia was studied through prolonged observations in free and controlled situations. One of the purposes of this study was to discover the factors determining correct recognition of objects in some situations and lack of recognition in others. It was found that living beings in action were better recognized by the patient than inanimate objects. Real objects which the patient was permitted to manipulate and use were recognized more readily than the pictured ones. Objects presented in an appropriate setting (fork with plate, pencil with paper) had an advantage over the same objects presented in isolation. Recognition was always preceded or accompanied by real or imaginary acting out of a situation relating to the object involved (eating, writing, etc.). Recognition of colors was extremely uncertain and faulty. Agnostic phenomena were found not to be limited to any one sensory field.

From these and other observations it was concluded that the patient was unable to recognize objects *in abstracto*, apart from the concrete action situation in which they could be meaningfully used. The agnostic symptoms were thus found to have the same basic structure as the aphasic symptoms and the disturbances of performance found in patients with brain lesions, and to reflect the general concretization of behaviour which Goldstein found to be typical of these patients. (Authors' abstr.)

The Role of the Father in the Development of the Personality of the Stutterer.

A study of 35 male stutterers suggests that there are certain relationships operating in the home which determine the type of personality that the male stutterer develops. Fifteen boys were selected for intensive study because the history and hours of therapy were more informative and because the author had personal contact with them. Although these boys are usually above average in intelligence with good school achievement, there is little striving in any other direction. They are passive, showing neither strong masculine nor marked feminine characteristics. Their interests and attitudes suggest, however, femininity.

The relationship with the mother is marked with change ; much hostility is shown at four years, diminishing to marked benevolence and dependence around eight years, and a suggestion that hostility recurs in adolescence. The attitude towards the father, while relatively without significance during the pre-school years, emerges clearly at about seven years. This consists of a feeling of dissatisfaction with him as a father, and a tendency to regard the mother as more adequate. In spite of his inadequacy, he is also pictured in a severely punishing role, and the mother becomes relatively an easier person with whom the boy may identify. In spite of repressed hostility towards her, she is less threatening to him than the father.

An hypothesis is developed in which stuttering is considered as evidence of a conflict in which the father is the cause of the boy's inability to resolve that conflict. The boy represses early his hostility towards a somewhat punishing mother because he finds her relatively more adequate to give him support. The father's inadequacy makes it easier for him to identify with the mother, but the ever-present threat of punishment for supplanting the father prevents complete identification. Caught between the two, he wavers passively without developing strongly either masculine or feminine characteristics. (Author's abstr.)

Hyperactivity in the Cat after Ablation of the Frontal Lobes and its Relation to Visually Controlled Aspects of Behavior.

This study is based upon the investigation of some 36 animals. In the cat, localized extirpation of the most rostral part of the cerebral hemispheres, i.e., the cortex anterior to the cruciate sulcus, produces generally marked hyperactivity. Limited lesions within this area may bring about temporary alterations of activity, following which the animal may return to its normal status. Extirpation of the cortex posterior to the cruciate sulcus within and including the boundaries of the so-called motor cortex does not produce these changes in activity, and if the motor areas are removed along with the frontal areas, the hyperactivity is no greater than that found with the frontal cortex removed alone.

Cats which display an increase in activity, as measured both by a stabilimeter and a rotating cage method, invariably portray forced following-responses to visual stimuli. This reaction consists of a very persistent tropistic-like following of moving objects or of a moving person.

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Animals which do not display this behavior do not show marked levels of hyperactivity. Accordingly, it is believed that the hyperactivity occurring after removal of the frontal lobes involves, in part at least, the modification of the inhibitory mechanisms of control of visual orientation. It is also concluded that the hyperactivity of the cat following removal of the frontal lobes may be accounted for in terms of a generalized modification of the same order in the sensory-motor system, for the same type of forced reactions to other stimuli may also be observed in the operated animals. (Author's abstr.)

Modification of Perceptual Responses in Patients with Unilateral Lesions of the Frontal Lobes.

To study the behavior of patients with unilateral frontal lobe lesions produced surgically 20 different experimental methods were used. The only positive results were obtained on tests which measured perceptual responses. The changes in perception are of such nature that they cannot be understood by postulating one basic principle, nor are the concepts which have thus far been advanced to explain the functions of the frontal lobes sufficiently comprehensive to interpret all of our results.

Five patients, four with a right frontal lobe lesion and one with a left, differed from the controls in the following ways: (1) The threshold of perception was raised so that the time to apprehend either a word or a geometrical figure was increased. (2) The number of objects perceived in ambiguous figures, resembling the Rorschach test, was decreased. (3) Visual illusions which are normally seen by everyone were either not perceived, or, in the case of the Muller-Lyer illusion, the illusion was exaggerated. (4) Memory for visually presented objects was decreased, which, interpreted in conjunction with other test results, may be due to a disturbance of attention. (5) The reversals of figures with reversible perspectives, such as Rubin's figures, the staircase, etc., were either absent or decreased, which may also be due to a function of attention.

In one patient a restitution of the reversals of figures with reversible perspectives was observed six months after the operation, and more completely a year later.

It is suggested that the elation of some patients with frontal lobe lesions may be due to the disturbed perceptual processes in which the ordinary inhibitory stimuli are no longer perceived as such. (Authors' abstr.)

Modifications of Design Block Performance Before and after Corpus Callosum Section.

This report discusses results of tests made on 18 epileptics before and after section of the corpus callosum. Psychological studies have been made by the Division of Psychiatry on these patients from the Division of Neurosurgery, pre-operative tests beginning in 1939–40. In the cases reported here no uniform Kohs' block design response pattern was found, but some post-operative performances resemble the type of response reported by other workers as accompanying known cerebral lesions. Persistence of the " organic " response is discussed in relation to intelligence test level, extent of post-operative apraxia, and psychiatric history. As periodic retests now continue, many patients reach pre-operative levels. (Author's abstr.)

Perceptual and Intellectual Factors in the Production of Concepts.

This paper reports part of a study on the production of concepts. The study as a whole investigates the hypothesis that the perception of objects is the dominant (neither the simplest nor the most primitive) mode of human cognition, and that the production of concepts is a variant of this dominant mode which may be regarded as the distinctive (though not dominant) mode of human cognition. Data from previously reported parts of the study indicate a regular and positive relationship between the length of time required for the production of a concept and the extent of the departure from perceptual modes of response its production involves.

The method used throughout the study is a modified form of Hull's procedure, which in turn is a modified form of a memory experiment. The subject's task is to learn the names (nonsense syllables) of successive series of drawings, presented at a uniform rate and in a systematically random order, and so arranged that it is possible, but not necessary, for the subject to respond to similarities from series to series, and eventually to identify each drawing by a name indicating its membership in a class. The procedure provides objective measures of the points in the experiment at which concepts are produced. The subjects were 173 college students, each of whom was studied individually. Each subject, if successful, produced nine concepts.

This paper concerns concepts produced under two contrasting sets of conditions. One set may be described as complex and concrete, the other as simple and abstract. Concepts were more readily produced under the first set of conditions. (Author's abstr.)

Normal vs. *Schizophrenic Perception of Similarities.*

The following study is based upon the hypothesis that it is possible to distinguish between normals and schizophrenics on the basis of differences in their conceptualization of similarities. It was believed that schizophrenics tended to categorize as similar those items which look alike, that is, have point-to-point similarities. Normals, it was thought, tended to see as similar those things having the same meaning, that is, functional rather than peripheral similarities.

Sets of pictures were designed to test this hypothesis. Fifty normal college sophomores and 50 schizophrenic subjects were given opportunity to match each of eight master pictures with either (*a*) pictures peripherally but not functionally similar to the master picture, or (*b*) pictures

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functionally but not peripherally similar to it, or (*c*) pictures neither functionally nor peripherally similar to it.

Scoring reported here is based on the frequency with which functionally similar pictures were matched to the master.

Odd-even reliability of the choices was ·914 ± ·01.

(1) Normals made significantly more choices of the functionally similar type than did the schizophrenics. Out of a maximum score of eight, the mean score of the normals was 7·45; of the schizophrenics was 3·57.

(2) Within the paranoid and hebephrenic groups of schizophrenics there is a marked correlation between absence of deterioration and frequency of matching based on functional similarity.

(3) Related to this, patients with superior prognosis made more functionally similar choices than did patients with poor prognosis. Thus, on the basis of psychiatrists' judgment, patients expected to be discharged within the month had a mean score of 5·43; patients expected to be discharged within a year had a mean score of 3·33; patients classified as probably incurable a mean score of 2·80. (Author's abstr.)

Deterioration in Schizophrenia as Reflected in Performance on a Variety of Psychological Tests.

This report is concerned mainly with the analysis of the relationship between two ratings of deterioration and the performance on several psychological tests of 25 schizophrenic patients. The psychological studies, carried out ten years ago, include the Stanford-Binet scale, the Army Alpha test, the Kent-Rosanoff Association test, the Rorschach test, and various aspects of motor function, including steadiness, speed of tapping, reaction time and learning. The first of the ratings, "contemporary deterioration," is based on the average of three ratings given independently by psychiatrists at the period of the psychological studies. The second of the ratings, "present deterioration," was obtained by averaging the rank orders in which the patients were placed by a group of six experienced persons on the basis of present status.

The correlation between the two measures of deterioration, after the lapse of approximately ten years, is ·73. Certain variables derived from the devices employed give coefficients in the range from ·45 to ·70 for both measures of deterioration. These are: Mental age and vocabulary on the Binet, Alpha sub-test, 3·0 + per cent. in the Rorschach test and simple auditory reaction time. Others give correlations of this magnitude for present deterioration alone; Alpha total score, discrimination visual reaction time and prod learning time. No variables give correlations of this magnitude for contemporary deterioration alone.

The implications of the above relationships for the understanding of deterioration, the light which the present findings throw on some previously proposed measures of deterioration and the suggestions which arise from the study for the construction of prognostic devices of deterioration in schizophrenia are considered. (Author's abstr.)

A Laboratory Method for Diagnosing Manic-Depressive Depression.

In a previous report it was shown that the parotid gland secretory rate of patients with manic-depressive depressions was lower than that of the lowest "average normal" individual. The present investigation set out to determine if this low rate was found in all types of depressions, or whether it was characteristic of only the manic-depressive depressions. A preliminary study on 50 cases was reported. This is a continuation of the investigation on an additional group where all the tests were performed by a technician as a part of the routine in the New York State Psychiatric Institute.

The findings can be summarized as follows: (1) Parotid gland rate determinations were made on a series of undifferentiated depressions before they were clinically studied. If the readings were below an average of ·01 c.c. per five minutes over a test of a half-hour duration the depression was recorded tentatively, in the experiment records, as a manic-depressive depression. No other differentiation was attempted. The results were then filed away for comparison with clinical diagnosis. (2) The clinical diagnosis in each instance was later made by two psychiatrists working independently. The diagnoses of the two psychiatrists were then compared. When an agreement on the diagnosis occurred, the case was included for report in this communication. These clinical diagnoses were then compared with the laboratory diagnoses based on the parotid secretory rate. (3) It was found that the laboratory diagnosis based on the parotid gland determination offered a quick objective means of making a diagnosis. (4) The parotid secretory rate is inhibited in the very early stages of the disorder before it is possible to make a definite diagnosis of manic-depressive depression by the usual psychiatric procedures. (5) Secretory inhibition prevails during the daily mood fluctuations of the patient, but the rate does return to the normal range when the patient recovers from the depression. (6) The rise of the secretory rate when the depression abates may be very sudden. (7) The parotid secretory test can be accomplished within an hour with simple inexpensive apparatus, involving little technical training. (Authors' abstr.)

A Study of the Use of Recent Memory Tests in the Measurement of Intellectual Deterioration.

In order to determine the extent to which objective test of recent memory might be used as an aid in the diagnosis and measurement of intellectual deterioration, a battery of seven

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recent memory tests was devised. The series consisted of tests making use of blocks, objects, a story, paired associates, photographs of faces, color order reconstruction, and a figure-ground test. The series required 30 minutes' administration time. The average intercorrelation of the seven tests was + ·30.

This battery of memory tests along with the Stanford-Binet vocabulary test (1937) was given to a group of 50 patients with diagnoses of organic brain disease of types generally believed to involve intellectual deterioration, and to a group of 50 normal control cases matched with the deteriorates on the basis of age, education and occupational level.

The scores on the sub-tests were weighted according to the extent to which each of the tests discriminated the two groups of subjects. In order to take into account the factors of age and former general intellectual level in interpreting the score on the memory test as a whole, the multiple regression equation for the total memory test score on age, grade level and vocabulary was computed for the control group. The discrepancy between the predicted memory test score and that actually obtained was then determined for each of the 100 subjects. Taking this discrepancy as a measure of deterioration, it was possible to set a critical score such that the deteriorated cases could be differentiated from the control subjects with an accuracy of better than 95 per cent. The data also showed significant differences between certain of the diagnostic sub-groups of subjects. (Author's abstr.)

Wechsler-Bellevue Test Results in Senile and Arteriosclerotic Patients.

Wechsler's list of tests which do and do not hold up with age is largely based upon cursory observation, since his standardization data did not include norms for the older age ranges (60 +).

The present study attempts to check the test-score pattern in senility as such, and compare it with the pattern observed in patients with cerebral arteriosclerosis in whom there is evidence of "interference with cerebral circulation."

The data were obtained from 84 records on patients between the ages of 60 and 80. Thirty-seven of this group were sclerotic.

The following tentative conclusions seem to be warranted: (1) The object assembly and picture completion tests, contrary to Wechsler, do not hold up with age. (2) Arithmetic and memory for digits are more affected in arteriosclerosis than in the other senile conditions. (3) The arteriosclerotic group shows a comparatively well-preserved "abstract" (Goldstein) approach as evidenced by the results on the block design and similarities tests.

(Author's abstr.)

Audiogenic Seizures Elicited in Rats by Tones of Low Frequency.

It has previously been shown that pure tones can elicit audiogenic seizures in rats, but that high frequencies in the neighbourhood of 20,000 cps are more effective than low ones. The threshold of audibility has also been shown to be lowest at these high frequencies. One might expect, therefore, that the elicitation of seizures is a function of intensity above the rat's threshold of hearing. This hypothesis was attacked in the present experiments by studying seizures elicited at low frequencies.

Pure tones of low frequency (500 to 10,000 cps) and high intensity, it was found, elicit from rats typical audiogenic seizures after a latent period of about 45 seconds. In every respect the behavior is like that following stimulation with keys, air-blasts, etc. The effectiveness of the different tones varies; 4,000 cps is most effective (14·9 per cent.), 500 cps is next (6·7 per cent.), but no pure tone is as effective as noises with high-frequency components (i.e., keys). Considering these results in relation to the acoustic intensities at which they occurred and to the rat's auditory threshold at different frequencies, one can draw the conclusion that sensation-level, not frequency, is the important aspect of the stimulus for eliciting epileptoid behavior in rats.

Further experiments with steady *vs.* interrupted tones (4,000 cps) gave the following results: Interrupted tones ($\frac{1}{8}$ second on, $\frac{1}{8}$ second off) are as effective as steady tones, but increasing the silent period ($\frac{1}{8}$ second on, $\frac{3}{8}$ second off) reduces the number of seizures obtained. The latent period before the epileptoid behavior appears is the same, however, regardless of whether the tone is interrupted or steady.

These two experiments, together with other findings, lead to a general theory of the neural processes underlying the seizures. (Authors' abstr.)

The Relation of Audiogenic Seizure to Blood Cholesterol, Sugar, Protein and Opacity.

Reports in the psychiatric literature indicate that mental disorder is dependent in some degree upon blood composition. The striking similarity of the behavior of the rat during audiogenic seizure to certain psychotic symptoms suggests that susceptibility to seizure may likewise be a function of the constitution of the blood.

An investigation of this possibility was undertaken by comparison of seizure-susceptible and non-susceptible animals with respect to level and variability of blood cholesterol, sugar, protein and red cell concentration.

The results point to three differences in level of blood constituents between the two groups of animals. The susceptible animals were higher than normal in blood-sugar and red-cell concentration, and lower in total protein. The groups differed in variability with respect to choles-

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terol, sugar and protein. In each of these three substances the variation of the seizure-susceptible animals was greater than that of the non-susceptible group. The significance of these results will be discussed. (Author's abstr.)

The Effect of Electroshock Therapy on "Interference" in Memory.

In a previous study we reported that the saving method shows no retention while the recognition method shows almost unimpaired retention after shock. In order to examine the discrepancy between these two methods a study of the interference effect was undertaken. Paired associates (household commodities paired with pseudobrand names) were taught before shock and again after shock and direct interference was introduced by utilizing the same commodities each time. Under control conditions the interference is marked, and we had expected that when shock is interpolated the interference would disappear. Instead it was accentuated. Our tentative conclusion is that electroshock treatment disorganizes but does not destroy the memory traces. (Author's abstr.)

Stability of the Personality Structure.

This investigation is concerned with the problem of permanence or fluidity of personality structure in adults. Personality patterns were studied in individuals examined more than once with the Rorschach test, and observed clinically over periods of time. Distribution: Shock treatment in schizophrenia, nine patients, 20 Rorschachs; in other conditions, eight patients, 17 Rorschachs; without shock but receiving adjustive therapy from psychiatrists or psychiatric social workers, 18 patients, 40 Rorschachs. Among the latter are included (*a*) extreme manic excitement and depressed states (one patient); (*b*) before outbreak of schizophrenia and in the psychosis (two patients); (*c*) in the psychosis and later in remission; (*d*) neurosis; (*e*) before psychoanalysis and in an interrupted phase of it in an adult of very superior level. Total: Patients, 35; Rorschachs, 77. Intervals between Rorschachs ranged from 8 days to 30 months. Ages: from 15 years, 5 months; only six were under 20.

Results: Except in the manic-depressive case, main outlines of the Rorschach patterns are always recognizable as belonging to the same individuals, but there are always changes in important features. E.g., following shock, most patients improve in intellectual control, usually at the cost of richness in mental life (impoverished content, reduced productivity, less affect and fantasy expression). The changes are thus at the "periphery" rather than the "core" of the personality. The two Rorschachs of the manic-depressive patient were as from two totally different persons.

Conclusion: The personality at the ages indicated follows permanently grooved-out channels. Even such dramatic treatment as shock does not refashion it basically. (Author's abstr.)

The Effect of Morphine upon the Rorschach Pattern in Post-addicts.

The Rorschach test was administered under morphine and non-morphine conditions to 22 drug addict patients who had been abstinent from morphine for at least six months. Patients were in good physical health and of average intelligence. Morphine was administered in amount sufficient to produce a satisfactory psychological state as judged by the individual subjects. The average dose was 34 milligrams, with a range from 15 to 70. It was found that the response total, details, rare details, and human movement responses were increased. Responses to color were also slightly increased, but the erlebnistypus shifted in the direction of introversion. Neurotic signs were reduced by morphine. Signs of intellectual control, organizational energy and originality were not affected. It therefore appears that under morphine the personality of post-addicts changes in the direction of introversion in the sense of increased fantasy living, with attention being directed toward inner more than to outer stimuli. (Author's abstr.)

"Signs," "Syndromes," and Individuality Patterns in Rorschach Reactions of Schizophrenics.

During the last five years various attempts were made to facilitate a clinical diagnosis based on the Rorschach reactions of various clinical subjects through the use of "signs," i.e., Rorschach characteristics, which occurred significantly more frequently in a specified group of clinical subjects than in any control group.

Five such "sign" patterns have been published and discussed in the literature: organic, neurotic, schizophrenic, general maladjustment and general adjustment "signs." These five "sign" patterns were applied to the Rorschach records of 20 diagnosed schizophrenics, 10 of whom were paranoid schizophrenics and 10 catatonic or hebephrenic schizophrenics.

The possibilities and limits of the "sign" approach are discussed in the light of the results of this application. An attempt is made to determine what qualitative Rorschach elements beyond the traditional "signs" in these records are characteristic for schizophrenics in general and for the two sub-groups in particular. The term "syndrome" is proposed for these Rorschach elements parallel to the clinical use of this term. (Authors' abstr.)

The Validity of the Rorschach Group Method.

An experiment is in progress at the Brush Foundation to convert the Rorschach method into a practical, reliable, and valid group method. The test has been administered individually and

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as a group technique by means of lantern-slides to two classes of college girls, 73 subjects to date. Report has been made elsewhere on the technical aspects of group procedure. The present paper discusses results on validity.

Validity is judged by the extent of agreement between group and individual records, and by the success of the group test in distinguishing the more neurotic, unstable, inhibited, and anxious types of personality.

Scores based on formulae developed for various traits—intellectual control, stereotype-originality, combinative, abstractive and generalizing ability, analysis-synthesis, control-spontaneity, emotional stability, extratensive adaptability, extratensiveness-introversiveness, and dilation-constriction—tend to fall in similar ranges for individual and group tests. Profiles of adjusted and maladjusted types of personality likewise show high percentage of agreement. Thus anxious personalities revealed by individual tests are likewise shown by group tests. In the former, however, there may be 8 indicators, while in the latter, only 5. Finally, total personality pictures developed independently from individual and group records show agreement in many general traits of personality.

Thus preliminary results with college girls warrant the expectation that certain important aspects of personality can be revealed in a group record. The group technique can classify college girls according to dominant personality traits and can differentiate the more neurotic, anxious, richly expansive and controlled personality. Group results cannot be viewed as unequivocal determination of the subject's personality, however, but only as a rough characterization. Where gross deviations are revealed, an individual examination can be given and the more subtle and finer nuances of personality ascertained. (Author's abstr.)

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The Treatment of Alcohol Addiction: A Review of the Literature.

Psychological methods of treatment include: Compulsory and punitive measures, generally effective with only 15–35 per cent.; psychosocial therapy; religious appeal, successful apparently in 30–70 per cent.; conventional psychotherapy in a controlled environment, such as farm or institution, giving 25–75 per cent. of cures, with adequate therapy including 20–100 hours of treatment; psychoanalysis, which so far has a lack of encouraging results; and hypnosis, for which there are no encouraging statistics. Physiological methods include conditioned reflex therapy, which with proper application gives 60–70 per cent. of cures; elevation of blood-sugar levels; spinal drainage; convulsive therapy; serotherapy; and autohemotherapy. Pharmacological methods are reviewed and adjuvant methods mentioned.

W. L. WILKINS (Psychol. Abstr.).

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Locomotor Movements in the Decerebrate Cat.

Six groups of decerebrate cats were prepared by sectioning the brain stem at various regions from the pons to the thalamus. On recovery, doses of coramine were administered, producing graduations of locomotor movements. No such reactions were obtained from the "bulbar" cats, while thalamic cats were capable of locomotion. Thus, the intermediate groups were studied more closely. Tables and curves are presented showing the degrees of response. The coramine method (cardiazol was used at first) is superior to that of electrical stimulation or of compression, since response patterns may be more closely observed. It is concluded that several integrated local centers are needed to produce integrated responses. Extirpation of the cerebellum did not substantially alter the results. H. D. SPOERL (Psychol. Abstr.).

REV. PSIHOL.

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The Contents of the Interpretations in the Rorschach Test and Their Relationships to the Subject.

This study is concerned with the nature and intensity of the affective reaction to Rorschach pictures, its influence on interpretations, and the possibility of repressing it in favour of the rational form factor. Experiments (questionnaire following the test) on normals, neurotics, and psychotics demonstrate that interpretations, superficially not unusual, often reveal themselves as complexes or symbols. The first orientation toward a picture is affective. Symbol answers are very frequent. A given picture evokes similar affects in various persons. If the connection between affect and interpretation is close, as in the case of complexes, the form is less clear. If affect is less persistent, a symbol or a masked complex is revealed. Schizophrenics can give little information about their affects. M. E. Morse (Psychol. Abstr.).

The Question of Refusal of Military Service on Religious Grounds.

Psychiatric literature on conscientious objectors is scanty. Moos gives Swiss references and relates his experiences with Jehovah's Witnesses. More than half of Maier's conscientious objectors (1933) were schizoid psychopaths; some were feebleminded; all had grandiose ideas. Moos believes that refusal of military service constitutes revolutionary behavior aimed at weakening the army, but the autistic tendencies of most objectors prevent them from proselyting. Even in peacetime the mentally abnormal should be rejected. There are, however, distinctions among objectors. Everyone's religious experience conflicts somewhat with realistic legal, social, and ethical duties. The sharper the conflict, the greater the probability that the person is not only peculiar, but that his religious thought is absolutely fixed and that he is inaccessible. A man who is willing to serve in any capacity except killing is still within the bounds of reality. If court-martialled, an objector is entitled to psychiatric study and recommendation.

M. E. Morse (Psychol. Abstr.).

VOL. XLVIII. 1942.

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Retrograde Amnesia following Electric Shock: A Contribution to the General Problem of Amnesia.

In 18 early schizophrenics Flescher studied the reproduction of engrams of various memory tests given just before the shock. The amnesia extended from a few minutes previous to the shock to 4–7 hours afterward. What does not appear spontaneously or through association or recognition at the end of this time is permanently lost. The amnesia consists exclusively in a disturbance of evocation. It is ascribed to a global, organic, reversible perturbation of mnemonic function due to the current but not otherwise definable. Certain psychological mechanisms which depend on the basic principles of memory function are also involved; the pleasure principle importance (physiological amnesia), and the biodynamic principle (importance for life), which may neutralize the pleasure principle or be manifested negatively as repression.

M. E. Morse (Psychol. Abstr.).

Mirror Writing in Disturbances of the Instincts.

Among 138 right-handed mental patients (schizophrenics, mental defectives, psychopaths), 16 spontaneously produced mirror-writing with the left hand. All the patients had some instinctive disturbances. Among 77 pupils in special classes, 6 were left-handed, but there was only 1 mirror-writer, a right-handed child. Mirror-writing is essentially one example of incapacity, due to immaturity or congenital or acquired limitation, to harmonize intelligence and instinct as expressed through motility. The normal subordination of instinct to certain intellectual demands is disturbed. In left-handed persons this maladaptation relates only to the left hand and is direct, simple, and isolated, without effect on the personality, whereas, in the right-handed, it usually betrays a disharmony of the entire personality. Another cause of mirror-writing is acquired organic lesions of the brain. In addition, for children of kindergarten age who have not yet learned systematically to write, script has a pictorial character, and they often, as a transitory stage, copy it in reverse.

M. E. Morse (Psychol. Abstr.).

TRUD. FIZIOL. LAB. PAVLOVA.

VOL. X. 1941.

*An Analysis of the Highest Nervous Activities of Dogs by Complex Secretory and Motor CR Methods. *Skipin, O. V.* . . . . . 5 and 17
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*Materials Towards an Understanding of the Physiological Mechanisms of Voluntary Movements. *Petrova, M. K.* 41

An Analysis of the Highest Nervous Activities of Dogs by Complex Secretory and Motor CR Methods.

One dog, "Leda," was used. The conditioned stimulus was a hissing sound to which was added, after 5 seconds, a passive flexion of the right foreleg. The salivary CR first appeared after 5 trials, while after the 8th trial the mere application of the sound resulted in the dog flexing his leg unaided. When the CR to the compound sound flexion stimulus was well established (106 reinforced trials), the animal would flex his leg to all other conditioned stimuli in his repertory—metronome, light, whirligig, scratching and the like. A conditioned inhibition to a passive flexion of the dog's right hind leg was then attempted. This inhibition was very slow in development as the dog would again and again flex his foreleg to the conditioned inhibitor. It was further observed that (1) flexing of the right foreleg would stop during the action of the unconditioned stimulus of feeding, (2) flexing would be resumed "voluntarily" after the feeding, (3) after-feeding flexing would occur even if no conditioned stimulus was applied before the feeding. The results are interpreted in terms of irradiation; positive, negative, and auto-induction; and interaction of cortical and subcortical elements.

G. H. S. Razran (Psychol. Abstr.).

An Analysis of the Highest Nervous Activities of Dogs by Complex Secretory and Motor CR Methods.

Two dogs, "Pishka" and "Kutzy," neither of whom had any previous CR's, were used. The conditioned stimulus in the first dog consisted of the sound of a metronome of 120 beats per minute to which was added, after 5 seconds, a passive flexion of the right foreleg (proprioceptive stimulus). In the second dog the CS was a light of 50 c.p. plus a similar flexion of the right foreleg. The CR to the compound stimuli developed quickly in both dogs, but the formation of an association between its two components (the animals' flexing their right forelegs upon the application of the sound or the light) was fraught with difficulties. In the first dog the association was attained only occasionally and only when, either the metronome was converted into a trace stimulus through a pause between its application and the subsequent flexing, or the flexing was performed by the experimenter and not by an instrument. In the second dog conditioned flexing was also irregular, and occurred only either when the light was increased in intensity or when the flexion was repeated a few times without reinforcement. The relative intensities of the components is the most determining factor for the association.

G. H. S. Razran (Psychol. Abstr.).

The Physiology of Conditioned Motor Defense Reflexes.

A series of experiments on three dogs clearly indicates that, with the usual technique of electric shock as the unconditioned stimulus, defense motor CR's manifest essentially the same

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attributes as those of salivary CR's, and may well be interpreted by the usual Pavlovian mechanisms. Beritov's contention that defense differential stimuli do not exhibit irradiation and concentration of inhibition and induction is disputed by a number of kymographic records. Thus, conditioned stimuli applied at various intervals after differential stimuli were first augmented (induction), then suffered decrements (irradiation of inhibition), and then returned to normal (concentration of inhibition). Again, mutual induction was found between conditioned and unconditioned defense stimuli contrary to Beritov's claims. Finally, conditioned defense responses could be extinguished controverting Beritov's statements. Extinction was easy when the non-reinforced trials were given at intervals of 1–2 minutes, but was very slow when the intervals were either too long (5 minutes) or too short (10–20 seconds).

G. H. S. RAZRAN (Pyschol. Abstr.).

Materials towards an Understanding of the Physiological Mechanisms of Voluntary Movements. Two 9-year-old dogs and one 1-year-old dog were used to see whether they would flex their legs to a preceding conditioned stimulus if the flexion, produced by means of a special instrument, was followed by feeding (Miller-Konorski technique). The first two dogs failed in the task although the flexion acquired salivary CR properties. The third dog succeeded. At first the conditioned stimulus was the experimenter's verbal stimulus nogu (foot, leg) accompanying the flexing, but later a metronome at 144 beats per minute became just as effective. Conditioned inhibition was tried in two ways. (1) Metronome and the flexion were not accompanied by food for the left hindleg, but were continually reinforced for the right hind leg. (2) Flexion of the right hind leg was combined with a stimulus other than the metronome and the combination not reinforced with food. In both situations the animal developed resistance or sleep. The failure of the first two dogs is attributed to old age and to the possession of too many old CR's.

G. H. S. RAZRAN (Psychol. Abstr.).

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Z. ARBEITSPSYCHOL.

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Z. F. PSYCHOTHERAP.

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1. Biochemistry, Anatomy, Physiology, Psychology, etc.

Biochemistry in Relation to Psychiatry. Gildea, Edwin F. [*Yale J. Biol. Med.*, **14**, 505–17 (1942).]
G. H. W. Lucas (Chem. Abstr.).

Pyruvic Acid Test for Vitamin B_1 Deficiency in Children. Wilson, E. Ellis C. [*Lancet*, (1), 199 (1942).]

The average pyruvic acid content of the blood in 35 children on home diets was 0·99 mgm. per cent.; that of 30 children on a hospital diet for 7–30 days following surgical operations was 1·05 mgm. per cent. The values do not suggest a vitamin B_1 deficiency. Higher values were found in children with gastro-enteritis, nephritis and convulsions, although no clinical signs of vitamin B_1 deficiency were present. Pyruvic acid was determined by the method of Klein (*C. A.*, **35**, 1079[1]).
E. R. Main (Chem. Abstr.).

The Occurrence of Fits in Pyridoxine-deficient Rats. Lepkovsky, Samuel, Krause, Myrtise E., and Dimick, Mildred K. [*Science*, **95**, 331–2 (1942).]

Pyridoxine-deficient rats show epileptic-like fits which may be due to disturbed water metabolism.
Felix Saunders (Chem. Abstr.).

Rice Diets and Beriberi. Aykroyd, W. R., and Krishnan, B. G. [*Indian J. Med. Research*, **29**, 551–5 (1941); *cf. Yang* (*C. A.*, **35**, 4857[8].)]

The incidence of beriberi in the Godavari district is lowest in the winter months when some parboiled rice is consumed, highest in August, September and October, after raw rice has been consumed for several months. The vitamin B_1 calorie ratios of the diets consumed in September were less than 0·25, below which according to Williams and Spies ("Vitamin B_1 and Its Use in Medicine," *C. A.*, **32**, 7085[4]), there is danger of development of beriberi.
M. H. Power (Chem. Abstr.).

A Case of Nicotinic Acid Deficiency. Villaret, Maurice, Justin-Besancon, L., Inbona, J. M., and Courchet. [*Bull. mém. soc. méd. hôp. Paris*, **56**, 615–17 (1940).]

In the case of this 39-year-old woman, who had been on a diet low in meat, milk and eggs, the blood nicotinamide, determined by the method of Lwoff and Querido (*C. A.*, **33**, 2928[9]), three days before beginning the treatment was 6·2 mgm./l.; this value is below normal and lies in the danger zone. After daily administration of nicotinamide alone or combined with nicotinic acid for four days, the blood nicotinamide rose to the normal value of 7·1 mgm./l. This increase in blood nicotinamide was accompanied by rapid clinical recovery.
Ruth Berggren (Chem. Abstr.).

Clinical and Pathogenic Analysis of Pellagra. Villaret, Maurice, Justin-Besancon, L., and Inbona, J. M. [*Bull. mém. soc. méd. hôp. Paris*, **56**, 617–19 (1940).]

The role of the different avitaminoses in the symptomatology of pellagra is given schematically. This analysis constitutes the first stage in the description of nicotinic acid deficiencies other than pellagra.
Ruth Berggren (Chem. Abstr.).

Pellagra and Internal Secretions. Hellwig, C. Alexander, and Forman, Louis H. [*Am. J. Clin. Path.*, **12**, 210–17 (1942).]

A fatal case of pellagra associated with severe endocrine symptoms was observed in a 38-year-old female. It was difficult during life to differentiate between pellagra and Addison's disease. The autopsy revealed marked atrophy of the adrenal cortex with loss of lipoid. The clinical and anatomic findings in pellagra cases suggest a relationship between the pellagra-preventing vitamin and the hormone from the adrenal cortex.
John T. Myers (Chem. Abstr.).

Studies of the B Vitamins in the Human Subject. IV. Mental Changes in Experimental Deficiency. O'Shea, Harriet E., Elsom, K. O'Shea, and Higbe, Ruth V. [*Am. J. Med. Sci.*, **203**, 388–97 (1942).]

Foresight and judgment, as measured by performance on maze tests, are impaired when the subjects are deficient in the B vitamins and are improved after therapy with thiamine or with the B complex. General intelligence, reasoning ability (reading) and speed of hand muscle co-ordination (tapping) show no measurable deterioration when the subjects are deficient in the B vitamins and no improvement after therapy with thiamine or with the B complex.

V. The Normal Requirement for Thiamine; Some Factors Influencing its utilization and Excretion. Elsom, K. O'Shea, Reinhold, John G., Nicholson, Joseph T. L., and Chornock, Charlotte. [*Ibid.*, 569–77).]

Six women with body weights of 95 to 202 lb. without previous evidence of deficiency subsisted on a constant daily diet containing thiamine in amounts just sufficient to meet the theoretical requirements as calculated by the Cowgill formula. Three other subjects received the same diet in amounts also adequate calorically, but supplying only about half the theoretical requirement of thiamine. Of the first group, three developed deficiency and three did not. Since it was the smaller members of the group who developed deficiency, the failure of the Cowgill formula to predict adequately the normal requirement is probably due to too great emphasis on body weight. The minimal thiamine intake adequate for health was for this group about 650 γ/day or about 0·35 γ/cal. The output of thiamine in the urine was directly correlated with the intake

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and not related to body weight, calorie intake or clinical deficiency. It was lowered in one case in the presence of infection and returned to normal when the infection subsided.

FERRIN B. MORELAND (Chem. Abstr.).

The Effect of Vitamin E (α-tocopherol) on Nervous Excitability. Chauchard, Paul. [*Compt. rend. soc. biol.*, **135**, 248–51 (1941).]

Vitamin E in the normal animal has at first an exciting action, followed by a depressing action on the nervous centres, especially the medulla. FELIX SAUNDERS (Chem. Abstr.).

Humoral Activity in the Central Nervous System. Alcalde, S. Obrador. [*Ciencia (Mex.)*, **2**, 337–44 (1941).]

A review with 50 references. E. H. (Chem. Abstr.).

Chemical Changes in Cerebral Cortex following Local Thermocoagulation and Local Freezing. Marshall, Clyde, Nims, Leslie F., and Stone, William E. [*Yale J. Biol. Med.*; **13**, 485–8 (1941).]

Thermocoagulation in an area in the cerebral cortex of cats anesthetized with pentobarbital promptly obliterated electric activity, creating a marked and lasting decrease in pH. Lactic acid and inorganic phosphate increased considerably, but phosphocreatine and hexo-phosphates decreased. After freezing, an area recovered somewhat as it was warmed up. The pH changes were slight and chemical changes small as compared with those following thermocoagulation.

G. H. W. LUCAS (Chem. Abstr.).

The Influence of Radioactive Substances on the Nervous System. Horst, L. van der. [*Deut. Z. Nervenheilk.*, **151**, 63 (1940); *Zentr. Gewerbehyg. Unfallverhüt*, **27**, 230 (1940).]

Ra D is found in the breakdown of radioactive substances in the human body. The blood damage was studied in rats and cats after the administration of radioactive water for long periods. Microscopically damage of the nerve cells was found which resembled that in Pb poisoning. Injuries of the central and peripheral nervous system through radioactivity or the Pb are, however, not to be expected with radioactive water of normal strength. The amount of Pb which reacted was not large enough to cause a Pb injury of the brain.

RUTH BERGGREN (Chem. Abstr.).

Brain Purpura in Poisoning with Nitrous Gases and a Study of the Morphology and Pathogenesis of Capillary Cerebral Hemorrhages. Winblad, St. [*Deut. Z. ges. gerichtl. Med.*, **33**, 73 (1940); *Zentr. Gewerbehyg. Unfallverhüt*, **27**, 177 (1940).]

RUTH BERGGREN (Chem. Abstr.).

Effect of Malonate and Iodoacetate on Respiration of Brains of Rats of Various Ages. Tyler, David B. [*Proc. Soc. Exptl. Biol. Med.*, **49**, 537–9 (1942).]

The brain of a newborn rat is comparatively insensitive to malonate. Full sensitivity develops during the first ten days of life. The results with iodoacetate seem to indicate that the brain of the newborn rat depends, for its aerobic metabolism, on some of the degradation products of glucolysis to a greater degree than does the brain of the adult.

L. E. GILSON (Chem. Abstr.).

Some Observations on Sleep. Dikshit, B. B. [*Calcutta Med. J.*, **38**, 98–9 (1941); *cf. C. A.*, **29**, 6651[2].]

An address on acetylcholine, which may be the "sleep-producing hormone."

RUTH BERGGREN (Chem. Abstr.).

Neuropathologic Findings in Experimental Starvation: Preliminary Report. Ferraro, A., and Roizin, L. [*Trans. Am. Neurol. Assoc.*, **67**, 177–81 (1941).]

Eight cats subjected to experimental total starvation, some however given water, showed global shrinkage of the central nervous system, with evidence of hyperemia of the soft meninges and brain parenchyma, but no grossly apparent hemorrhages. Histological examination of the nervous system showed an increase in the number of blood vessels and thickening of their walls; this phenomenon varied greatly in the eight cases studied. Other effects of inanition were marked hypertrophy and hyperplasia of astrocytes, lipoid accumulation in the liver and adrenal cortex, and vascular proliferation in the intestinal submucosa. The studies are being continued in an attempt to establish the influence of vitamins B_1 and B_2 and other vitamins on the life and pathological findings in animals subjected to inanition. MARION HORN (Chem. Abstr.).

The Choline Esterase Activity of Blood Serum in the Stages of Neuromuscular Transmission. Salvestrini, H., Luco, J. V., and Huidobro, F. [*Ciencia (Mex.)*, **2**, 351–2 (1941).]

An increase in the amount of acetylcholine is accompanied by an increase in choline esterase. Direct stimulation of denervated or curarized muscles does not increase the choline esterase of the blood. Indirect stimulation of normal muscles with low frequency (17 per second) increases the amount of choline esterase by about 100 per cent. The value returns to normal in about 20 minutes. A similar effect is seen when the frequency is about 85 per second.

FELIX SAUNDERS (Chem. Abstr.).

The Effect of Acetylcholine on the Electrical Activity of the Cerebral Cortex. Merritt, H. Houston, and Brenner, Charles. [*Trans. Am. Neurol. Assoc.*, **67**, 152–4 (1941).]

Application of acetylcholine chloride to the cerebral cortex of the cat produces a temporary

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marked increase in the electrical activity of the cortical neurons, strikingly similar to the electrical changes occurring in *grand mal* seizures in man. It is suggested that disorders of acetylcholine metabolism may be concerned in the mechanism of human convulsive seizures. The fact that application of the anticonvulsant compound dilantin sodium produces a prompt and marked reduction in electrical response to acetylcholine lends some support to this hypothesis. Evidence that acetylcholine is normally rapidly destroyed by the cholinesterase of the brain is afforded by the fact that prostigmine methyl sulfate (which is known to inactivate the cholinesterase of the cortex) greatly increases and prolongs the electrical effect of acetylcholine. Similarly, acetyl-β-methylcholine and carbamyl-choline, which are relatively or completely resistant to cholinesterase, have a more marked and prolonged electrical effect on the brain than has acetylcholine.

MARION HORN (Chem. Abstr.).

The Effect of Ventriculocentesis on some Humoral Substances. Ansaldi, Inocencio B., and Camoirano, Jorge E. [*Bol. inst. psiquiat., Facultad cienc. med. Rosario (Argentina)*, **5**, *Pt.* 2, *No.* 27, 39–48 (1941).]

After the extraction of a certain quantity of cerebro-spinal fluid from the ventricle there is an increase in the concentration of glucose and cholesterol in the blood and a decrease in Cl. When the fluid is extracted by lumbar puncture the variations are not constant.

E. S. G. BARRON (Chem. Abstr.).

Vitamin C Level in Cerebro-spinal Fluid. Kasahara, M., and Gammo, I. [*Z. ges. Neurol. Psychiat.*, **163**, 551–3 (1938); *cf. C. A.*, **33**, 5048[8]; **34**, 1721[8].]

When 30 or 70 mgm. of ascorbic acid per kgm. body weight was injected subcutaneously in human infants or monkeys, respectively, cerebro-spinal fluid obtained 4 and 24 hours after the injection showed an increase in vitamin C content.

B. C. P. A. (Chem. Abstr.).

Choline Level in Cerebrospinal Fluid in Organic Nervous and in Mental Diseases. Yūki, K. [*Arch. Psychiat. Nervenkrankh.*, **109**, 235-46 (1939).]

A modification of Takayama and Wada's micro test for choline is described and comparative findings are given of this method and of biology assay. Increase in cerebrospinal fluid choline was found in 21 out of 31 cases of general paralysis of the insane, in epilepsy (6 out of 9 cases), manic-depressive insanity (11 out of 23), schizophrenia (9 out of 20), but in only 1 of 8 cases of neurosyphilis or tabes dorsalis.

B. C. P. A. (Chem. Abstr.).

Tryptophan in Cerebrospinal Fluid of Patients with Tuberculous Meningitis. Jequier, M., and Roten, J. L. [*Schweiz. med. Wochschr.*, **71**, 95–7 (1941).]

Fifteen c.c. of concentrated HCl and 2–3 drops of 2 per cent. formaldehyde are added to 3 c.c. of cerebrospinal fluid; after five minutes, 2 c.c. of 0·06 per cent. $NaNO_2$ is added; tryptophan is present if a violet ring forms. The reaction was positive in 78 per cent. out of 51 patients suffering from tuberculous meningitis; in these cases the diagnosis was already certain from other clinical and serological signs. It was also positive in other neurological diseases (e.g. cerebral tumour, polyneuritis).

B. C. P. A. (Chem. Abstr.).

The Antigenic and Anaphylactogenic Properties of the Cerebrospinal Fluid. Mogilevskii, M., and Sil'd, I. [*Z. Mikrobiol. Epidemiol. Immunitätsforsch.* (*U.S.S.R.*), No. 4, 101–4 (1941), (*in German*, 101.)]

Immunization experiments on rabbits with the cerebrospinal fluid of cattle and dogs indicate that the cerebrospinal fluid possesses antigenic and anaphylactogenic properties. The fluid does not possess an organic specificity, but exhibits a type specificity inherent to the proteins of the blood serum. This indicates that the normal proteins of the fluid originate in the blood.

W. R. HENN (Chem. Abstr.).

Phosphatides in Cerebrospinal Fluid in Schizophrenia. Roeder, F. [*Allgem. Z. Psychiat.*, **112**, 44–50 (1939); *cf. C. A.*, **84**, 8036[8].]

Low values were found in early and late stages of schizophrenia.

B. C. P. A. (Chem. Abstr.).

The Electro-encephalogram in Addison's Disease. Hoffman, W. Christie, Lewis, Roger A., and Thorn, Geo. W. [*Bull. Johns Hopkins Hosp.*, **70**, 335–61 (1942).]

In 18 of 25 patients with Addison's disease, definite abnormalities were observed in the resting patterns of the electro-encephalogram. These changes were characterized by: (1) the presence of oscillations which were slower than the normal α rhythm, which had a predilection for the frontal area of the cerebral cortex, and which were refractory to the usual effect of opening the eyes; (2) an unusual sensitivity of the electro-encephalogram to voluntary hyper-ventilation; (3) a reduction in incidence of low voltage high frequency activity (β waves). The abnormalities during rest may progress during therapy with synthetic hormone. Treatment with desoxycorticosterone acetate, aqueous adrenal cortical hormone, crystalline components of the vitamin B complex and a diet high in readily available carbohydrate failed to correct the abnormality of the resting pattern. However, adrenal cortical extract therapy and intravenous injection of glucose in certain patients markedly reduced the sensitivity to hyperventilation.

ZELMA BAKER MILLER (Chem. Abstr.).

Spontaneous Beriberi of the Monkey as Compared with Experimental Avitaminosis. Leblond, C. P., and Chaulin-Servinière, J. [*Am. J. Med. Sci.*, **203**, 100–9 (1942).]

Twenty cases of beriberi were observed in a *Macacus sylvanus* colony on a diet partially

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deficient in vitamin B_1. Treatment with crystalline thiamine produced incomplete cures, suggesting that a prolonged deficiency produces permanent lesions. In complete experimental B_1 deficiency, death occurred before any marked symptoms set in. The observations suggest that only a partial thiamine deficiency results in beriberi.

FERRIN B. MORELAND (Chem. Abstr.).

Investigation of the Occurrence of Polypeptidases in the Central and Peripheral Nervous Systems. *Abderhalden, Emil, and Caesar, Günther.* [*Fermentforschung*, **16**, 255–62 (1940); *Chem. Zentr.*, 1940 (**1**), 2956–7; *cf. C. A.*, **31**, 3083[3].]

Experiments were carried out to detect the presence of enzyme systems, especially of polypeptidases, in the central and peripheral nervous systems. The first work was done with dry powdered nerve tissue which had been prepared with the use of acetone and ether. The dry powder was extracted with glycerol or 0·9 per cent. NaCl solution. The results obtained were not uniform, since several times inactive extracts were obtained. In the second series of experiments extracts of fresh tissue were used. Fresh brain tissue was triturated with sand and kieselguhr and subsequently extracted as above. Work was also done with the expressed fluids. With the fluids so obtained tests were made in the usual manner on the absorption and elution of the enzymes. In this way it was shown that dipeptidases, aminopolypeptidases, prolinase and acylase are present in the brain. The dipeptides used were dl-leucylglycine, glycyl-dl-leucine, glycyl-l-tyrosine and l-alanyl-l-tyrosine, the last of which was not split up. The cleavage of both dl-leucylglycine and dl-leucyglycylglycine from extracts of the white brain matter was greater than that of the same compounds extracted from the gray matter. The stability of the enzyme solutions used was low. After as little as 24 hours there was a distinct decrease in activity while the activity disappeared almost entirely after 96 hours. The expressed fluids behaved similarly. It was found that when the ability to split up dl-leucylglycine had been completely lost, enzyme solutions which had been stored for a long time nevertheless hydrolyzed the tripeptide, dl-leucylglycylglycine. Experiments were carried out to determine whether the addition of certain substances had any effect on the enzyme activity. Acetylcholine and aneurine produced no definite effect. Negative results were likewise obtained with HCN and with $MgCl_2$. Other experiments were carried out to test for the presence of polypeptidases in the peripheral nerves. It was shown that leucylglycine, glycyl-l-tyrosine, dl-leucylglycylglycine and silk peptone were hydrolyzed. The microscopic method was used to detect the action of enzymes by following the hydrolysis of polypeptides and peptones having tyrosine as a constituent of the molecule. Glycyltyrosine and tyrosine-rich silk peptone were used as substrates. The separation of tyrosine could be seen under the microscope even when no evidence of cleavage could be detected by titration of the solutions. Thin sections of fresh rat brain were used for these experiments. These were placed with a drop of the substrate solution on a microscope slide, covered with a cover glass, and incubated in a moist atmosphere at 37°. After 12 hours, tyrosine crystals could be seen separated in typical clusters. These results were obtained with a saturated solution of glycyl-l-tyrosine, a 20 per cent. silk peptone solution or a saturated solution of chloroacetyl-l-tyrosine. No separation of crystals occurred when l-alanyl-l-tyrosine was used. When glycyl-l-tryptophan was used as substrate the splitting off of tryptophan could be followed under the microscope by the use of the Br water reaction. Autolysis experiments with brain tissue under various conditions gave negative results. W. A. MOORE (Chem. Abstr.).

Neuraminic Acid, the Cleavage Product of a New Brain Lipoid. *Klenk, E.* [*Z. physiol. Chem.*, **268**, 50–8 (1941).]

A new N-containing organic acid has been isolated by cleavage of the brain lipoid obtained from the cerebroside fractions of the $CHCl_3$–MeOH extract (*C. A.*, **35**, 3225[6]) and the name neuraminic acid is proposed by Klenk. The lipoid is separated from the recrystalized P-free cerebrosides by repeated extractions with acetone containing 5 per cent. by volume H_2O. The lipoid remains as insoluble residue, is dissolved in $CHCl_3$–MeOH and filtered. The filtrate which has been concentrated *in vacuo* is precipitated with acetone, yielding a pure-white or slightly yellow substance (10–14 gm. from 100 gm. cerebroside fraction) with a sugar contant of 25–27 per cent., calculated as galactose (Loening and Thierfelder method, *C.A.*, **6**, 881), P O 3–0·6 per cent. (impurities), N 2–2·5 per cent., ash of alkaline reaction 2–2·5 per cent. The lipoid is soluble in H_2O (clear solution), $CHCl_3$–MeOH (4 : 1 by volume), C_6H_6–EtOH (10 : 1 by volume), pyridine, slightly soluble in EtOH and MeOH, insoluble in acetone and Et_2O. Five gm. of the lipoid is decomposed by heating to 105° for three hours with 125 c.c. of MeOH–HCl (5 per cent.) in a sealed tube. The solution is extracted repeatedly with petroleum ether to remove the fat acid methyl esters, freed from the solvent by careful distillation *in vacuo* and the residue is dissolved in 75 c.c. of MeOH, freed from HCl by a hot solution of Pb $(OAc)_2$ in MeOH (excess Pb is removed by H_2S) and evaporated *in vacuo*; 100 c.c. of Et_2O is added to the residue, the Et_2O solution is extracted with 20 c.c. of H_2O, the aqueous solution which gives a strongly positive reaction with Bial reagent for orcinol in made alkaline with $Ba(OH)_2$ and the voluminous precipitate is extracted with Et_2O to which a small amount of MeOH might be added. The alkaline aqueous solution and the aqueous solution of the syrupy, Et_2O-insoluble part of the residue, made alkaline with $Ba(OH)_2$, are freed from the excess $Ba(OH)_2$ by CO_2, concentrated on the steam bath (any very noticeable discoloration should be avoided), and the remaining 5–10 c.c. of solution is dried in a desiccator over H_2SO_4, suspended in 5–10 c.c. of MeOH and treated with about 100 c.c. of acetone; the precipitated white Ba salt of neuraminic acid is washed with acetone,

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suspended in a little MeOH and precipitated with acetone, filtered, transferred immediately to a desiccator and dried over H_2SO_4. Excess $Ba(OAc)_2$ is removed by precipitation of the aqueous solution (15 c.c. of H_2O) with a slight excess of H_2SO_4 (1 N) and filtration over kieselguhr; AcOH is removed by extraction in a Linde apparatus with hydrated lime in the boiling flask, and Et_2O is removed by CO_2. The solution is decolorized by activated charcoal, made alkaline with $Ba(OH)_2$, the excess removed with CO_2, the solution concentrated freed from $BaSO_4$ and $BaCO_3$, concentrated again and dried in the desiccator to avoid yellow discoloration. The dried material is dissolved in MeOH and the Ba salt of neuraminic acid is obtained by precipitation with acetone (yield 1·2 gm.). The P-containing impurities (0·15–0·16 per cent. P) are removed by heating 1·0 gm. of the substance in a closed flask with 25 c.c. of a concentrated solution of $Ba(OH)_2$ (containing 8 gm. $Ba(OH)_2$) in a N_2 atmosphere for 90 minutes in a boiling water bath. Chloride ions are removed by Ag_2SO_4 and silver ions by H_2S. The almost colorless solution is concentrated at 40° *in vacuo* to 1–2 c.c., the solution is decolorized with charcoal and the last traces of Ba are precipitated diluting with H_2SO_4. Alcohol is added (2–3 volumes) to the clear, colorless solution and the free neuraminic acid crystallizes on rubbing with a glass rod. The yield is increased by the addition of more alcohol and standing overnight at 0°. The pure-white substance gives off water of crystallization on warming to 50° in high vacuum and the anhydrous substance is somewhat hygroscopic; it chars at 200° without melting; it is very soluble at H_2O, slightly soluble in MeOH, insoluble in EtOH and Et_2O and shows a strongly acid reaction toward litmus. On titration with phenolphthalein as indicator it behaves as a monobasic acid but the color change of the indicator is not sharp. The purified acid (recrystallized from H_2O) corresponds to $C_{10}H_{19}NO_8$ or $C_{11}H_{21}NO_9$ and has $[\alpha]_D^{20} = -54{\cdot}91°$; N is present as amino N only. The acid is decomposed by diluting strong acids but is stable in neutral or alkaline solutions even when heated. The neutral solution gives a positive ninhydrin reaction, negative Trommer reaction, strongly positive reaction with Ehrlich reagent for aldehydes and, in very small concentrations on boiling, an intensive-red color with Bial reagent. The test for aminohexoses was negative. HANS SCHINDLER (Chem. Abstr.).

A Micromethod for the Estimation of Cerebrosides in Nerve Tissue. Edman, P. V. [*J. Biol. Chem.*, **143**, 219–21 (1942).]

A colorimetric method is given for the quantitative estimation of cerebrosides by use of the carbazole reaction of Dische (*C. A.*, **24**, 1879). After hydrolysis of the cerebrosides the fat acids and the glycerol are removed. The fat acids are separated through their insolubility in water and the glycerol is taken up in EtOAc. The method can be applied to 0·2–0·6 mgm. of cerebrosides. FELIX SAUNDERS (Chem. Abstr.).

Metabolism of Brain Suspensions. (1) *Oxygen Uptake. Elliott, K. A. C., and Libet, B.* [*J. Biol. Chem.*, **143**, 227–46 (1942); *cf. C. A.*, **35**, 786[7], 7491[4].]

Suspensions of brain tissue, prepared by homogenization in media made isotonic with salts, sucrose or glucose, respire up to 400 per cent. faster than suspensions prepared in hypotonic medium. Additions of salt or sucrose to suspensions homogenized in hypotonic medium cause increases up to 65 per cent. in the respiration rate. Isotonic urea solution behaves like hypotonic medium. The initial respiration of glucose containing NaCl-isotonic brain suspensions is considerably decreased by small amounts of Ca or Mg, but these ions improve the maintenance of activity. Mg has little effect in the absence of glucose or in hypotonic suspensions. The presence or absence of bicarbonate has no effect. NaCl, Na_2SO_4 and Na phosphate have specific stimulating effects. K is inhibitory. Suspensions respire initially at the same rate in air as in O. After an hour the respiration is progressively inhibited by O. O inhibition can also be shown with slices of cortex. Dilution of isotonic suspensions with isotonic medium has little effect on the activity per unit weight of tissue. The activity of hypotonic suspensions decreases somewhat on dilution. Homogenization in hypotonic medium causes brain largely to lose the power of oxidizing glucose. Small additions of citrate to glucose containing isotonic suspensions cause increases in the initial respiration rate which are dependent on the presence of Mg. With or without Mg, citrate improves the maintenance of rate. In the absence of glucose and in hypotonic suspensions, citrate has no effect or inhibits slightly. Malate causes an initial acceleration of respiration, followed by some inhibition in the presence or absence of glucose and Mg. Its accelerating effect is larger with hypotonic suspensions. Fumarate slightly accelerates the initial respiration of isotonic suspensions and improves maintenance of rate. With hypotonic suspensions, fumarate causes considerable initial acceleration, but less than malate does and inhibition does not set in. Heated liver extract causes considerable initial increase in respiration, especially with hypotonic suspensions, followed by an inhibition. Insulin has no effect. Metrazole, in relatively high concentration, inhibits respiration. The respiratory activities of slices of cortex and suspensions of whole brain are compared. Slices and suspensions behave in most respects in the same way, and isotonic suspensions are possibly more suitable, and are much more useful preparations for brain metabolism studies. FELIX SAUNDERS (Chem. Abstr.).

Retroactive Inhibition as a Function of the Relative Serial Positions of the Original and Interpolated Items. Irion, A. L. [*Proc. Ia Acad. Sci.*, **48**, 325–9 (1941).]

The experiment was intended to investigate the effects of identical and changed serial order between the original and interpolated lists when the lists were composed of synonyms and when

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they were composed of identical words. The inhibitory action of changed serial position was found to be to a large extent a function of the material to be learned. The interpolated learning of the original material in a changed order was capable of producing as much inhibition as the interpolation of synonyms either in the same or in a changed order.

B. WELLMAN (Psychol. Abstr.).

A Post-repeal Study of 300 *Chronic Alcoholics. Lowry, J. V., and Ebaugh, F. G.* [*Amer. J. med. Sci.*, **203**, 120–4 (1942).]

In the six years following repeal (1933) the average number of admissions per year for chronic alcoholism at the Colorado Psychopathic Hospital was 147 per cent. higher than the average for the two years preceding repeal. The New York State Hospitals had a similar experience. Only a few of the Colorado patients seriously wished to be cured. One-third were psychotic. Chronic alcoholism began before the age of 30 in most of the cases. Many were reared in family situations complicated by alcoholic or otherwise inadequate relatives and showed poor emotional reactions during childhood. Only 10 per cent. had made good adult economic and marital adjustments. Only 6 per cent. had a good prognosis at discharge. As far as could be determined, 20 per cent. remained sober for a minimum of six months after discharge, 30 per cent. returned to their pre-hospitalization status, and no information was available on the remainder.

M. E. MORSE (Psychol. Abstr.).

Rorschach Tests and Native Personality in Alor, Dutch East Indies. Dubois, C., and Oberholzer, E. [*Trans. N.Y. Acad. Sci.*, **4**, 168–70 (1942).]

The Rorschach responses of the Alorese differ from the typical responses of the normal European or American in their lack of movement answers and form color reactions. Certain specific Alorese responses are found elsewhere only in certain pathological states of mind, especially in the defective states of the traumatic constitution. It is inferred from these data that " the personality and emotional character of the Alorese are very different from normal Europeans and Americans," and observation bears this supposition out. F. W. FINGER (Psychol. Abstr.).

Chronic Alcoholism and Suicide; A Contribution to Bandel's Theory of the Influence of Alcoholism on Suicide Mortality. Shimshony, Z. [*Schweiz. med. Wschr.*, **71**, 1429–33 (1941).]

Bandel demonstrated a connection between fluctuations of alcohol consumption in Germany and Italy and male mortality and male suicide incidence. Shimshony confirms this theory by Swiss statistics from 1876 to 1930. The suicide rate of alcoholics exceeds that of non-alcoholics. The greatest number of male suicides and the heaviest alcoholism both fall in the sixth decade. Alcoholism is bound up with suicide because it increases economic stress, inferiority feelings, and therefore disgust with life. A sudden welling-up of remorse, bitterness, or rage may lead to an impulsive suicide, or alcohol may be taken to facilitate a planned suicide.

M. E. MORSE (Psychol. Abstr.).

Prognosis of Mental Instability; Adolescent and Service Cases. Hall, S. B., and Hall, M. B. [*Lancet*, **242**, 376–8 (1942).]

The prognosis of mental instability is considered in the light of experience gained from (*a*) intensive study of more than 1,500 adolescent patients and follow-up records in a consecutive series of 317 of these; (*b*) detailed psychiatric investigation of 330 service cases referred to an E.M.S. neurosis centre. An attempt has been made to assess the significance of the problem from the community standpoint, in four of its main aspects—mental defect, psychoneurosis, psychopathic personality, delinquency. The relative seriousness of the problem of psychoneurosis is stressed. Whether reaction to mental conflict will take the form of psychoneurosis or of delinquency depends on fundamental differences of personality structure. When the reaction takes the form of delinquency, the prognosis seems to be more favorable. Our experience had a practical application if the problems which have arisen in connection with the conscription of men are to be avoided among conscripted women. C. K. TRUEBLOOD (Psychol. Abstr.).

2. Pharmacology and Treatment.

Pathophysiology of Periodic Catatonia. IV. Therapeutic Results. Gjessing, R. [*Arch. Psychiat. Nervenkrankh.*, **109**, 525–95 (1939); *cf. C.A.*, **33**, 8279[1].]

Control of Fatigue through Physiological Agents. Morell, Th. [*Deut. med. Wochschr.*, **1**, 398 (1940); *Zentr. Gewerbehyg. Unfallverhüt.*, **28**, 42 (1941).]

Mental fatigue is believed to result from chemical changes in the reactivity of the central nervous system. This reactivity can again become normal through the administration of chemical substances of physiological nature, as vitamin C. Other such substances which act on the oxidation-reduction processes of the cells also enter in. Such physiological agents can increase the performance for rather long periods. On the basis of these considerations, a preparation (vitamultin) has been developed which contains vitamin C and the B complex (vitamins B_1 and B_2 and nicotinic acid) and dextrose, which is the most important nutrient molecule, if the vitamin B and C metabolism proceeds within physiological limits. The administration of vitamultin can control symptoms of physical and mental fatigue without danger of unpleasant side or after reactions upon prolonged consumption. Simultaneously the performance is increased. These results are of special significance for workmen, as long-distance truck drivers and fliers, who may suffer from severe fatigue which can cause accidents.

RUTH BERGGREN (Chem. Abstr.)

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The Effect of Carbon Monoxide on the Inner Ear and its Nucleus in the Medulla Oblongata. Popov, N. F. [*Vestn. Otol. i t. d., No.* 5, 471 (1938) (*in Russian*); *Zentr. Gewerbehyg. Unfallverhüt.*, **27**, 107 (1940).]

In addition to other organs, both the peripheral receptors and the central portions of the inner ear in the medulla oblongata (tuberculum acusticum, triangular nucleus, Deiters' nucleus) are affected in CO poisoning. The changes are initially caused by functional circulatory disturbances with simultaneous anoxemia and disturbances in the nutrition of the structural elements of the inner ear through the histotoxic action of CO. Almost all the clinical symptoms referable to the inner ear in man after CO poisoning can be explained by the changes found in experimental animals (mice, cats, dogs). There are circulatory disturbances with extravasations of blood by frank hemorrhage and by diapedesis and alterations of the nerve cells, part of which are reversible. RUTH BERGGREN (Chem. Abstr.).

Insulin and Metrazole Shock in Rabbits. Lohmann, R. [*Allgem. Z. Psychiat.*, **113**, 185–209 (1939).]

In animals that had died from insulin or metrazole shock and in others that had recovered from 15 or 20 shocks, weight of dried substance, total P, phospholipins, total N, residual N, glycogen, Cl, Ca and K were determined in brain, muscle and serum. Increase in cerebral and muscle glycogen in the latter series was the only uniform finding.

B. C. P. A. (Chem. Abstr.).

Action of Phenylcinchoninic Acid in Preventing Experimentally-produced Convulsions in Rabbits. Pollock, L. J., Finkelman, I., and Tigay, E. L. [*J. Pharmacol.*, **74**, 365–8 (1942).]

Suitable doses of phenylcinchoninic acid, given orally or intravenously, significantly reduce the severity or prevent the occurrence of convulsions after intravenous injection of convulsant doses of metrazole. L. E. GILSON (Chem. Abstr.).

Action of Diphenylhydantoin on the Central Nervous System. Gley, P. [*Compt. rend. soc. biol.*, **135**, 307–8 (1941).]

Diphenylhydantoin is distinguished from barbiturates by the absence of depression of the excitability of the motor cortex, the existence of motor phenomena during general intoxication and lack of antagonism towards convulsant poisons. FELIX SAUNDERS (Chem. Abstr.).

Untoward Effects of Phenytoin-sodium in Epilepsy. Finkelman, Isidore, and Arieff, A. J. [*J. Am. Med. Assoc.*, **118**, 1209–12 (1942).]

Forty-one patients were treated with phenytoin-sodium (Na diphenylhydantoinate). It produced a variety of serious side effects involving the nervous system and also the heart. Toxic effects on the gastro-intestinal tract and skin were likewise observed.

S. MORGULIS (Chem. Abstr.).

Recent Research on Experimental Alcoholism. Lhermitte. [*Bull. mém. soc. méd. hôp. Paris*, **56**, 390–2 (1940); *cf. C.A.*, **32**, 6739[6].]

Female rabbits received the following diets: Group I a normal diet of bran, bread and abundant fresh vegetables; Group II, a deficient diet consisting only of bread; Group III, the deficient diet together with subcutaneous injections of vitamin B_1. All the animals received a daily oral dose of 2–5 c.c. absinth (Pernod 40°). Group II rabbits died on the 42nd–44th days of poisoning; they had received, on an average, 305 c.c. absinth. Histological examination revealed highly significant degenerative lesions of the central nervous system, in contrast to the almost complete integrity of the peripheral nerves, and hepatic changes, as moderate periportal sclerosis, foci of insular necrosis and degeneration of the hepatic cells. Group I rabbits died on the 242nd–327th days. The nervous degenerative lesions were much more discrete while the liver showed degeneration and sclerous lesions, which were at times very marked. One Group I rabbit which had also been given intravenous injections of heterogeneous serum (hémostyl) died after it had received 560 c.c. absinth in 112 days; histological examination revealed a very marked cirrhogenous hepatitis associated with diffuse degeneration of the hepatic cells. In two animals, in which alcohol intoxication was combined with P poisoning, the liver showed very extensive fatty degeneration, while the cirrhogenous reaction was mild; these rabbits died after 81 and 130 days. Vitamin therapy prolonged the survival period notably (three months in one case), compared with that of the Group II rabbits, and protected the liver and central nervous system, but increased the sensitivity of the peripheral nervous system. The livers of the offspring of rabbits which had been given absinth also showed profound alterations.

RUTH BERGGREN (Chem. Abstr.).

Effect of 2, 4-Dinitrophenol on Rat Brain Respiration at 25 and 37·5°. Fuhrman, Frederick A., and Field, John, 2nd. [*Proc. Soc. Exptl. Biol. Med.*, **49**, 504–7, (1942).]

The optimum concentration of 2, 4-dinitrophenol for stimulation of O consumption in excised rat cerebral cortex is approximately the same as 25 and 37·5°, but the maximum value of the stimulation ratio and the minimum inhibitory concentration are considerably greater at 25° than at 37·5°. L. E. GILSON (Chem. Abstr.).

Action of Several Poisons of the Autonomous System on the Vascular Effects of Trinitrin. Bariéty, Maurice, and Kohler, Denyse. [*Compt. rend. soc. biol.*, **135**, 484–7 (1941); *cf. C.A.*, **36**, 2928[9].]

Ephedrine and norephedrine augment the vasodilatation and hypotension produced by small

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quantities of trinitrin. This augmentation persists after, and is even reinforced by the administration of atropine and sympatholytic substances. Atropine and the greater part of the sympatholytic substances studied exercise a distinctive action on the vascular effects of trinitrin, which they augment to a slight though definite degree. The action of these poisons toward trinitrin is the same as that toward histamine. FELIX SAUNDERS (Chem. Abstr.).

Yohimbine and the Vasomotor System. Action of the Alkaloid on the Vasomotor Centers. Tournade, A., Chardon, G., and Calleja, Alb. [*Compt. rend. soc. biol.*, **135**, 544–5 (1941); *cf. C.A.*, **36**, 3266[8].]

According to the dose which is injected into the blood, yohimbine paralyzes more or less the vasomotor endings and the sinus receptors. It spares the general vasomotor centers.

FELIX SAUNDERS (Chem. Abstr.).

The Vasomotor System and Yohimbine. Action of the Alkaloid on the Periphery of Vasomotor Nerves of the Foot of the Dog under Chloralose. Tournade, A., Chardon, G., and Calleja, Alb. [*Compt. rend. soc. biol.*, **135**, 444–6 (1941); *cf. C.A.*, **36**, 3266.[8]]

Injection of yohimbine into the femoral artery produces a vasodilatation of the muscles of the foot. The greater the dose, the greater the effect. After sufficient yohimbinization (5–10 mgm. of the local circulation, direct intra-arterial injection of adrenaline produces a vasodilatation if the dose is weak, but a stronger dose produces a vasoconstriction. Faradization of the sympathetic chain produces a vaso-constriction in the yohimbinized foot, but adrenaline produces the opposite effect.

Action of the Alkaloid on the Sinucarotid Receptors. [*Ibid.*, 446–8.]

In addition to the effect which it has on the endings of the vasomotor system, yohimbine paralyses the sinucarotid receptors. FELIX SAUNDERS (Chem. Abstr.).

Modification of the Conditioned Response under Nembutal. Headlee, C. R. [*Proc. Int. Acad. Sci.*, **50**, 193–8 (1941).]

Six dogs were conditioned to lift the right rear leg by the buzz-shock method. "Each dog was given training on four different days, separated by from one to two weeks, totalling 400 trials." A hypnotic dosage of nembutal, administered interperitoneally, was given to three dogs on the first and third days, to the three other dogs on the second and fourth session of 100 trials each. "Recordings were made of the movements of all four limbs, and the conditioned lifts of each of these limbs were measured and tabulated according to absolute frequency, total amplitude, and several other measures." Some qualitative observations are reported and two pairs of learning curves presented. "The learning process could take place even under the inhibiting influence of a depressing drug, though at a lower level and rate. . . . The learning curve here found approximates the typical conditioning sigmoid curve."

G. R. THORNTON (Psychol. Abstr.).

Narcotic Potency of Biurets containing Piperidine. Anderson, Hamilton H., Ch'eng, Charles H., P'an, Shih-Yi, Sah, Peter P. T., and Lu, Ch'ing Shan. [*Science*, **95**, 254–6 (1942); *cf. C.A.*, **35**, 4491[6].]

1-Diphenyl-5-phenylbiuret (m. 134°), 1-phenyl-5, 5-pentamethylenebiuret (m. 153°), 5, 5-pentamethylenebiuret (I) (m. 121°) and 1, 1-pentamethylene-5, 5-pentamethylenebiure (II) (m. 198°) were prepared. All are crystalline and (except (I) slightly soluble in water and alcohol. (I) is less toxic for mice than are Na barbital, Na pentobarbital and Na 5, 5-diphenylhydantoin, but more toxic than paraldehyde. The LD_{50} for mice is 600 mgm./kgm. on intraperitoneal injection. This amount antagonizes a surely fatal dose of picrotoxin and usually of strychnine, but does not protect mice against cocaine. Hypnotic doses of (I) in rabbits (60 mgm./kgm. given intravenously) slightly depress blood pressure and cardiac rate during the injection only, but do not affect respiration or uterine activity. Inhibition of human and rabbit uterine strips occurs in dilutions of 1 : 2,500 to 1 : 5,000 given *in vitro*. (I) depresses O uptake by rat liver by 35 per cent. during a 60-minute period. (II) is less toxic for mice. It antagonizes cocaine convulsions but does not save mice given lethal amounts. No protection against strychnine convulsions is provided, and all picrotoxin-treated mice had convulsions after an LD_{50} dose of (II) but none of them died. Smaller doses of (II) than of (I) are inhibitory of uterine strips *in vitro*. O consumption of rat liver is depressed more by (II). Narcosis of mice, rats and rabbits produced by (II) resembles that of pentobarbital. FELIX SAUNDERS (Chem. Abstr.)

The Relation between the Intensity of a Narcotic Effect and Physicochemical Properties of Substances. Shekhter, E. S. [*Farmakol. i. Toksikol.*, **3**, Nos. 1–2, 14–17 (1940); *Chem.Zentr.* (**11**), 1172 (1940).]

The adsorption of toluene, benzene, ether and acetone by activated charcoal was compared to the partition coefficient between oil and water. It was found that narcotic effect, adsorption, and partition coefficient of the investigated narcotics behave analogously.

M. HOSEH (Chem. Abstr.).

The Hypnotic Action of 2-Iminobarbituric Acids. Barré, Roger, and Jacques, Adrien. [*Rev. can. biol.* (1), 454–63 (1942).]

The starting-point of the syntheses was 2-thio-5, 5-diethylbarbituric acid (I), very slightly yellow needles, m. 177°, soluble in 88 times its weight of H_2O, soluble in the cold in ETOH, $CHCl_3$, Et_2O and Me_2CO, sparingly soluble in C_7H_8, insoluble in C_6H_6, obtained in total yield

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of 45 per cent. by the following unpublished modification (devised by Gosselin and Court for the preparation of thioamytal) of Fischer and Diethey's method (*Ann.*, **335**, 334–68 [1904]) for the preparation of symmetrical dialkyl alcohols: To 60 gm. ethyl diethylmalonate and 24 gm. dry powdered thiourea add 180 c.c. absolute alcohol, reflux to dissolve the thiourea, add EtONa (13 gm. very pure Na dissolved in absolute alcohol), reflux 5–6 hours, neutralize as exactly as possible with concentrated HCl, remove most of the alcohol at low temperature under reduced pressure, dilute the residue, make strongly acid, let stand a few hours in the cold, filter, wash with H_2O, drain and recrystallize from H_2O. A large number of additional very fine crystals are obtained by diluting the filtrate with a large volume of H_2O and cooling, and a further quantity by concentrating the mother liquor and washings. 2-Butylimino-5, 5-diethylbarbituric acid, needles m. 159–60° very soluble in cold alcohol, Me_2CO and NaOH solution, insoluble in H_2O, Et_2O, C_6H_6, $CHCl_3$ and CCl_4, was obtained in 52 per cent. yield as follows: to 5 gm. (I) add 3 gm. $BuNH_2$ which dissolves (I) with evolution of heat, reflux till evolution of H_2S ceases, cool, treat the brown highly viscous reaction product with CCl_4 which starts preparation, filter, wash with CCl_4 and then with Et_2O. A further crop of crystals can be obtained from the filtrate by removing CCl_4 and taking up the gelatinous residue in hot H_2O-alcoholic mixture. The same yield can be obtained by refluxing (I) with $BuNH_2$ in absolute alcohol. Attempts to prepare 2-imino-5, 5-diethylbarbituric acid by passing NH_3 through a saturated solution of (I) in absolute alcohol gave rise to an equilibrium resulting in very poor yields. It was obtained in 63 per cent. yield (m.p. above 300° without decomposition) from diethylmalonate and guanidine carbonate by a method similar to that used for the preparation of (I). 2-Thio-5-ethyl-5-isoamylbarbituric acid (thioamytal), m. 175–6° was obtained in 45 per cent. yield from ethyl ethylisoamylmalonate and thiourea by a method similar to that used for (1). 2-Imino-5-ethyl-5-isoamylbarbituric acid (iminoamytal), m. without decomposition above 300°, insoluble in the ordinary solvents, very soluble in NaOH solution, was obtained in 55·7 per cent. yield by condensation of ethyl ethylisoamylmalonate and guanidine carbonate in presence of EtONa. 2-Imino-5, 5-dipropylbarbituric acid was obtained in 65 per cent. yield by condensation of ethyl dipropylmalonate and guanidine carbonate in presence of EtONa. 2-Phenylimino-5, 5-diethylbarbituric acid (II). m. 251–2°, was obtained by Einhorn's method (*C.A.*, **2**, 1696) by heating (I) and freshly distilled $PhNH_2$ for 12–14 hours at 120–30°, extracting the phenylimino acid with 95 per cent. EtOH and purifying by fractional crystallization in alcohol. The five 2-iminobarbituric acids were tested on rats. Only (II) showed hypnotic properties. Introduction of an imino radical in the 2-position of 5, 5-diethylbarbituric acid destroys the hypnotic power, which is not restored by introduction of Bu in the imino group. The hypnotic action of (II) seems to be due to its greater ease of hydrolysis into 5, 5-diethylbarbituric acid. A. PAPINEAU-COUTURE (Chem. Abstr.).

Electroencephalographic Changes Induced by Intravenous Sodium Amytal. Cohn, R., and Katzenelbogen, S. [*Proc. soc. exp. Biol., N.Y.*, **49**, 560–3 (1942).]

Thirty-six electro-encephalograms were made on 25 young dementia praecox patients before and after injection of an average dose of 0·3 gm. of sodium amytal. "There is a definite and characteristic change in the human electro-encephalogram following the slow intravenous administration of sodium amytal. The change is marked by the early appearance of a rhythmic oscillation, with a frequency of approximately 20 waves per second, in place of the individual's 'spontaneous,' or control pattern. This action is not specific for the barbiturate derivatives. It is a general concomitant of early 'depressed' cortical activity."

H. PEAK (Psychol. Abstr.).

Action of Narcotics on the Chemical Excitability of the Frog (Türck Reflex). Barbital and Chloral. Lapicque, L., and Lapicque, M. [*Compt. rend. soc. biol.*, **135**, 244–81 (1941); *cf. C.A.*, **36**, 2632³.]

Barbital suppresses the inhibitory action of the brain, just as does section of the medulla. At first chloral has the same action, but later there is an effect on the medulla which in turn decreases the chemical excitability. FELIX SAUNDERS (Chem. Abstr.).

Effects of Testosterone Acetate and Propionate and of Estradiol Dipropionate upon the Resistance of the Rat to Evipalsodium, Nostal, Pernoston and Pentobarbital-sodium. Holck, Harald G. O., Mathieson, Donald R., Smith, Edwin L., and Fink, Lewis D. [*J. Am. Pharm. Assoc.*, **31**, 116–24 (1942).]

Testosterone acetate in a dosage of 0·125 mgm. per rat daily for two weeks or 0·500 mgm. for one week significantly shortened the response of the rat to the barbiturate pernoston. Eleven doses of 0·0625 mgm., given twice daily, shortened the response of normal female rats to evipal, but 10-day hormone treatment with twice this dose given daily, or 0·5 mgm. daily for ten days, failed to influence the male rat response to this barbiturate. Likewise, 0·125 mgm. of the hormone given daily per adult female mouse for one week failed to alter the response to evipal. Treatment of about one week's duration with daily doses of 0·125 mgm. testosterone acetate per rat significantly and to about the same extent shortened the response to evipal in both normal and spayed female rats. Treatment for two weeks with 0·25 mgm. per rat daily of the more powerful testosterone propionate shortened the response to evipal in adult and young female rats to that of the male level, and even reduced the depression time in the male; treatment of the male rats with double this daily hormone dose for two additional weeks was about as effective as the dose of 0·25 mgm. per rat. Ten-day treatment of male and female rats with

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1 mgm. per kgm. of testosterone (as the propionate) failed to influence the acute depression time and the incidence of delayed deaths following administration of the barbiturate nostal, to which the untreated rats showed a measurable sex difference for the first time in the authors' experience. Three or ten-day administration of 1 mgm. per kgm. of testosterone (as the propionate) daily or double this dose for ten days did not influence the percentage of male rats which developed tolerance to gradually increasing doses of Na pentobarbital. However, the lowered percentage of castrated male rats which developed tolerance was brought up to the normal level by either three- or ten-day hormone administration in the dosage just given. The hormone administration did not increase the average maximum dose of pentobarbital that tolerant normal or castrated males detoxified within 90 minutes. Whereas three-day administration of 1 mgm. per kgm. of testosterone (as the propionate) failed to increase definitely the percentage of normal female rats which developed tolerance to pentobarbital, ten-day treatment was signally effective in this respect; doubling the dose of the hormone did not cause further improvement. The somewhat increased percentage of tolerance consequent upon spaying of female rats was further increased by three-day administration of the hormone and brought up to the male level by ten-day treatment. This latter also increased the average maximum dose of pentobarbital detoxified within 90 minutes by tolerant spayed females. When estradiol (as the dipropionate) was administered in a dosage of 1 mgm. per kgm. daily for ten days to normal male and female rats, it caused severe loss of body weight in the males and, later on, marked reduction in the size of the testes in most cases. Whereas this hormone did not influence the female reaction time to evipal, it markedly lengthened this in case of the males; this effect persisted at least six weeks after cessation of hormone medication when these male rats were again gaining weight. Five, 30 and 300γ, respectively, of estradiol per kgm. (as the dipropionate) were administered ten, five and one day before, and on the day of beginning medication with gradually increasing doses of pentobarbital and once daily thereafter, to rats which developed tolerance. Vaginal smear tests were positive when the barbiturate was first given; also, definite effects were noted upon the average weights of the uterus and uterine tubes and of the seminal vesicles. The only change in effects that could be detected was always a lessened ability to develop tolerance to pentobarbital, and, with the highest dose of hormone, a lowered average maximum dose of pentobarbital detoxified in 90 minutes by tolerant young rats of either sex. When a heavy dosage of testosterone propionate was given simultaneously with a moderate dosage (0·030 mgm. per kgm.) of estradiol, which latter failed to influence the castrated male rat response, the beneficial action of the male hormone upon tolerance was observed in its usual degree. A. PAPINEAU-COUTURE (Chem. Abstr.).

Pharmacological Interactions of Cobra Venom and Thiamine. Macht, David I., and Spencer, Elizabeth C. [*J. Am. Pharm. Assoc.*, **31**, 146–50 (1942).]

Administration of suitable amounts of vitamin B_1 to mice makes them more resistant to cobra neurotoxin, while excessive doses of thiamine are toxic in this respect. Mice maintained on diets deficient in vitamin B_1 are less resistant to cobra venom. Deficiency of thiamine in rats does not affect the analgesic potency of cobra neurotoxin.

A. PAPINEAU-COUTURE (Chem. Abstr.).

Influence of Temperature on the Stimulation of Oxygen Consumption of Isolated Brain and Kidney by 2, 4-Dinitrophenol. Fuhrman, Frederick A., and Field, John, 2nd. [*J. Pharmacol.*, **75**, 58–63 (1942).]

The maximum acceleration of O_2 consumption was at 32° for rat cerebral cortex and at 22° for rat kidney cortex when 2, 4-dinitrophenol was added in 0·0000335 M concentration.

L. E. GILSON (Chem. Abstr.).

Studies on Pain. Measurement of the Effect of Ethyl Alcohol on the Pain Threshold and on the "Alarm" Reaction (in Man). Wolff, H. G., Hardy, J. D., and Goodell, H. [*J. Pharmacol.*, **75**, 38–49 (1942).]

In three subjects weighing 65–66 kgm. the maximum pain-threshold-raising effect of ingested EtOH was approximately 45 per cent. elevation above the control level. The minimum amount of 95 per cent. EtOH producing this maximum effect was 30 c.c. With 90 c.c. the effect was more prolonged, lasting about four hours. A combination of 30 c.c. of 95 per cent. EtOH and 0·3 gm. acetylsalicylic acid had the advantages due to the alcohol, namely, swift elevation of the pain threshold and the desirable feelings of contentment, relaxation and freedom from anxiety, coupled with the longer duration of the pain-threshold-raising effect of the acetylsalicylic acid. Like the opiates, EtOH accentuated the ability to dissociate pain perception from the fight-flight-anxiety reaction pattern of pain. In contrast to the uniformity of the threshold for the perception of pain, the threshold for the alarm reaction, as determined by decrease in electric resistance of the skin, varied widely in different individuals and in the same individual from day to day. The threshold for the alarm reaction was elevated to a remarkable degree by 30–40 c.c. of EtOH. L. E. GILSON (Chem. Abstr.).

The Psychological Effects of Sodium Bromide. Trowbridge, Lowell S., Moore, Merrill, and Gray, M. G. [*J. Tenn. State Med. Assoc.*, **35**, 142–5 (1942); *cf. C.A.*, **36**, 1970⁹.]

A daily dose of 2·6 g. NaBr for six weeks does not appear to have any effect on the behaviour of the individual, as measured by the strength of grip, speed of voluntary muscular response,

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reaction time and attention. There were individual differences in the amount of Br accumulated in the blood, a finding consistent with individual tolerance and uncontrolled salt intake. Although the same dose was given in each instance, the highest levels of accumulation in each case varied from 59 to 150 mgm. Br per 100 c.c. blood. RUTH BERGGREN (Chem. Abstr.).

Cerebral Findings in Acute Experimental Phosphorus Poisoning. Takeya-Sikô. [*Arch. Psychiat. Nervenkrankh.*, **109**, 113–27 (1939).]

In dogs which had been given 0·06–0·5 gm. of P, intracerebral or subarachnoidal hemorrhage was a regular finding; fatty degeneration of the brain was never seen. Small necrotic foci, especially in the cortex of the end-brain, were found in most, and advanced degeneration of the large and medium-sized nerve-cells of the end-brain in some cases.

B. C. P. A. (Chem. Abstr.).

The Influence of Benzedrine on Work-decrement and Patellar Reflex. Alles, Gordon A., and Feigen, Geo. A. [*Am. J. Physiol.*, **136**, 392–400 (1942).]

Doses of 10, 20 or 40 mgm. of benzedrine sulfate (I) inhibit the production of voluntary muscular fatigue. Like doses of (I) may abolish essentially complete voluntary muscular fatigue maintained by repeated but static work trials. The effect is related fairly well in degree and time with the patellar-reflex activity effects of (I). The effect is more marked than that with ten times as great a dosage of caffeine under the same conditions.

E. D. WALTER (Chem. Abstr.).

Does Bismuth Pass into Brain after [Intramuscular] Administration of Spirobismol Solubile? Strobel, T. [*Allgem. Z. Psychiat.*, **113**, 328–38 (1939).]

Bi was not detected in the cerebral tissue of rabbits which had received up to a total of 12 c.c. of spirobismol solubile (=360 mgm. of Bi) with or without simultaneous administration of pyrifer (producing artificial fever). B. C. P. A. (Chem. Abstr.).

Treatment of Equine Encephalomyelitis (Western) with Certain Sulfonamide Compounds: An Experimental Study. Schlotthauer, C. F. [*Proc. Staff Meetings Mayo Clinic*, **17**, 187–9 (1942).]

The efficacy of sulfanilamide, sulfathiazole, sulfadiazine, promin (Na p, p′-diaminodiphenylsulfone-N, N′-didextrosesulfonate) and 8 unnamed sulfonamide drugs was tested in guinea-pigs which had received intracranial inoculations of 0·2 c.c. of a 30 per cent. emulsion of infected guinea-pig brain in physiological saline solution or inoculations of 0·2 c.c. of a similar brain emulsion into the pad of the left hind foot. Since intracranial inoculation often causes transient anorexia, the animals received the drugs for four days or more before inoculation to insure a satisfactory hemoconcentration of the drug in the early stages of the disease. None of the drugs used appeared to have any specific inhibiting effect on this virus. All the treated and untreated guinea-pigs which had received the virus intracranially succumbed and 91 per cent. of the treated and 75 per cent. of the untreated guinea-pigs which had received the virus in the pad of the left hind foot died. Similar intracranial and foot pad inoculation made in vaccinated guinea-pigs did not cause any apparent ill effects. Since these drugs could not prevent the development of equine encephalomyelitis in experimentally infected animals, it is doubtful if they would have any therapeutic value in treating this disease.

RUTH BERGGREN (Chem. Abstr.).

The Action of Pyridine, some of its Derivatives, and Phenylcinchoninic Acid in Preventing Convulsions Produced by Metrazole. Pollock, Lewis J., Finkelman, Isidore, and Tigay, Eli L. [*Trans. Am. Neurol. Assoc.*, **67**, 6–10 (1941); *cf. C.A.*, **36**, 2923[2], 3554[1].]

Marked antagonism to the convulsant action of intravenous metrazole in rabbits was exhibited by pyridine, given intravenously and orally before the metrazole, by nicotinamide given intravenously and by 2, 6-dimethylpyridine-3, 5-dicarboxylic acid and cinchophen (route not specified). Pyridine-HCl, given intravenously, likewise was an effective anticonvulsant, but caused too much pain to be tried in many animals. Less marked anticonvulsant action was exhibited by oral nicotinamide, and by nicotinic acid (route not specified). Sodium nicotinate showed little or no anticonvulsant activity, while pyridine thiocyanate, conium and sparteine caused fatal poisoning in doses insufficient to prevent convulsions (routes of these compounds not specified). Intravenous injections of pyridoxine-HCl, 2′-butoxy-2, 6-diamino-5, 5′-azopyridine (Niazo) and diiodopyridoneacetic acid diethanolamine (Diodrast) were not anticonvulsant. The mode of action of pyridine and some of its derivatives in inhibiting metrazole convulsions remains to be discovered. A direct chemical antagonism is excluded by the lack of anticonvulsant effect when pyridine and its derivatives were first mixed with the metrazole and then injected. Effect via peripheral vasodilatation is excluded by the fact that nicotinic acid, which produces vasodilatation, is less effective than nicotinamide, which does not. Since pyridine and its derivatives and cinchophen do not prevent convulsions due to picrotoxin or to the passage of alternating current through the head, their antagonism to metrazole convulsions does not seem to be related to changes in intracellular oxidations through an action on a coenzyme, nor to a specific depressant effect upon the reticular formation of the brain stem (on which picrotoxin acts) nor to a general narcotic action. A detoxicant mechanism is suggested but not proved. Glycine likewise afforded very notable protection against metrazole convulsions.

MARION HORN (Chem. Abstr.).

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Part I.—Original Articles.

SYMPOSIUM ON PRE-FRONTAL LEUCOTOMY.*

THE INDICATIONS FOR PRE-FRONTAL LEUCOTOMY.

By T. PERCY REES, M.D., M.R.C.P., D.P.M.,
Medical Superintendent, Warlingham Park Hospital.

THE frontal lobes form the latest stage in the evolution of the brain. There has been much speculation as to their functions, and they have been described by some as biological luxuries and parasitic growths. It is, however, inconceivable that an organ appearing so late in the scheme of evolution should be completely devoid of function. Since the introduction of pre-frontal leucotomy evidence as to their function has been growing, and it may be said that the consensus of opinion now is that the frontal lobes are concerned with imagination, the social sense, self-consciousness, and the projection of the self into the future; these functions are synonymous with Freud's super-ego, so that, in fact, we may regard the frontal lobes as the seat of the super-ego.

The essential feature of pre-frontal leucotomy, according to Freeman and Watts, is the division of the fibres connecting the frontal lobes with the thalamus. The thalamus is the seat of the instincts—Freud's libidinous impulses. Functional mental disorder in the terms of Freudian psychology is due to a conflict between the super-ego and the libido, or, to put it in anatomical terms, between the frontal lobes and the thalamus.

This hypothesis, which may have no basis in fact, is nevertheless helpful in choosing suitable cases for prefrontal leucotomy, and in explaining its effects. Without the frontal lobe there can be no super-ego, without the super-ego no conflict, and without conflict, no functional mental disorders.

Among the most common symptoms of mental conflict are anxiety, groundless fears about the future, suicidal tendencies, self-mutilation, states of tension, destructiveness and attacks of uncontrollable violence, and it is patients who exhibit any of these symptoms to a marked degree who derive the greatest benefit from leucotomy.

There are doubtless many people who go through life making little or no use of their frontal lobes and leading a merely vegetative existence. Others spend so much time wondering what other people are thinking about them and what the future has in store for them that their activities are completely paralysed. It is good for us to show some regard to what others think of us and even to what we think of ourselves, and sometimes to contemplate the future, but when this is done to such a degree as to prevent us from reacting in a normal manner to our existing environment, then the frontal lobes call for the attention of the physician, and if he is not successful, the surgeon.

The super-ego is largely a product of education and upbringing, and this may account for the fact that the results I have seen are incomparably better in the

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private than in the rate-aided patients, or perhaps it would be more accurate to say in the educated than in the uneducated patients.

The effects of the operation, in well-selected cases, are often immediate and sometimes dramatic. The patient loses his fears, his anxiety, his apprehension and nervous tension. His delusions may persist, but they no longer worry him nor affect his conduct. The introvert becomes extraverted, sometimes even hypomanic, and self-consciousness is replaced by a feeling of self-confidence. According to Hunt, there was no appreciable difference in the intelligence quotient in a series of 40 patients before and after operation.

In my own series of 30 patients there were two post-operative deaths. Nine patients have been discharged, of whom five are earning their own livelihood, three are middle-class housewives managing their own homes, and one is attending a Ministry of Labour Centre for training in engineering. Of the 19 remaining in hospital, 6 are very much the same as they were before the operation; the others show varying degrees of improvement, particularly in conduct and ease of nursing management. I anticipate that three more should be well enough for discharge within the next two or three months. To me the most striking feature is that none of the patients can be deemed to be worse after the operation than before.

Effects of Leucotomy in Different Forms of Mental Disorders.

It will be seen from what has already been said that pre-frontal leucotomy is indicated not in any specific type of mental disorder, but rather for the relief of such symptoms as anxiety, apprehension, self-mutilation, suicidal tendencies, destructiveness, attacks of violence and states of tension which may be found in many forms of psychoses or psycho-neuroses. Nevertheless, it may be profitable to consider the effects of leucotomy in some types of mental disorders.

(a) *Schizophrenia.*—Although the results of pre-frontal leucotomy in schizophrenia have not been so satisfactory as in some other forms of mental disorder, it is possibly upon schizophrenics that most leucotomies have been performed in this country. The best results have been obtained in patients who are excitable, restless, destructive, violent, or who show suicidal impulses or tendencies to self-mutilation; in other words, in cases where there are symptoms suggestive of active mental conflict. Many such patients get temporary remissions following convulsion therapy. Such remissions, however, are often of very short duration, and I can recall one patient who could only be managed by the nursing staff provided she had a daily convulsion. This patient, who had a pre-frontal leucotomy about sixteen months ago, made rapid improvement after the operation and, according to her own doctor, is now apparently quite well and is running her own house.

Some schizophrenics are apparently well immediately they recover from the anaesthetic; in other patients the beneficial effects of the operation may be delayed for six months or longer. A complete social recovery cannot be expected in every case and sometimes the patient is left with his delusions and hallucinations, but they no longer worry him nor do they affect his conduct.

The worst results in schizophrenia are obtained in patients who lead a purely vegetative existence and show no evidence of active mental conflict. They generally belong to the simple or hebephrenic group, and there are grounds for believing that these are organic nervous diseases and not functional mental disorders. They show little appreciable change after the operation, neither do they respond to any other known form of treatment. It is a waste of time severing the connections of frontal lobes that have ceased to function; furthermore, inferences drawn from statistics which include the results obtained from a large number of such cases may bring the operation of pre-frontal leucotomy unfairly into disrepute.

(b) *Depressive states.*—Excellent results in the treatment of depressive states, particularly involutional depressions, by pre-frontal leucotomy have been reported by various writers. Unfortunately for the surgeon, the results of convulsion therapy are so good that there are very few patients left for him to deal with, and the number of chronic melancholics in mental hospitals that practise shock-therapy has been reduced to-day almost to vanishing point. However, there still are some cases who do not respond to shock therapy or who continually relapse. Such patients may, with advantage, be submitted for operation.

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(c) *Obsessional neurosis.*—It appears from the literature that the best results of all in pre-frontal leucotomy are obtained in the obsessive tension states. Many of these obsessions produce little or no disability, and it is only in a relatively small proportion of such cases that their disability is so severe as to render it necessary for them to enter a mental hospital.

Psycho-analysis is often unsuccessful in severe obsessional states, and, where the disability persists in spite of treatment, and is so great as to require the patient to enter a mental hospital or to prevent him from earning his livelihood, the operation is indicated.

When to Operate.

Perhaps the most difficult question of all to decide in connection with the indications for pre-frontal leucotomy is the stage in the disease at which the operation should be performed. Although good results have been reported in cases of five years', or even of twelve years' standing, most people will agree that the operation should be performed, if it is expected to give the best results, at a much earlier stage, but some undoubtedly will maintain that such an operation should not be carried out at all. Emotional attitudes of violent and unreasoning opposition are not uncommon when a new form of treatment is introduced. This was, and still is, the case with Freudian psychology and, more recently, with shock-therapy, so that it is not in the least surprising to find similar opposition to an operation on the brain which is undoubtedly a destructive operation, and leaves the patient incapable of reaching the highest form of mental development.

Pre-frontal leucotomy, however, does not represent the first effort of the surgeons to alleviate mental suffering. The tonsils, the sinuses, the appendix, the clitoris, the ovaries and the testes have on numerous occasions provided the field of action for surgeons collaborating with psychiatrists in the treatment of mental disorders. What is, indeed, surprising, is that the brain, the organ of the mind, has been left alone for so long. There is a tendency in mental hospitals to practise certain forms of treatment to the exclusion of others, and whether a patient is given psychotherapy, electric convulsion treatment, insulin comas, or somnifaine or deprived of his tonsils, may depend very largely on the hospital to which he is admitted. Psychiatry is not an exact science, and shows no signs of becoming one in the near future. This being the case, psychiatrists especially should be eclectics, and always ready to apply any treatment known to have been beneficial in any particular case.

The first stage in the treatment of any mental disorder, or in fact preceding any treatment, is the exclusion of organic disease, whether it be organic disease of the nervous system or of some other organ, or a focus of chronic sepsis which interferes with the normal working of the nervous system. Until this is done, we cannot be certain that we are dealing with a functional mental disorder.

The most logical way of dealing with mental conflict is the readjustment of the relationship between the frontal lobes and the thalamus, or perhaps one should say between the super-ego and the id, by means of psycho-analysis. Unfortunately, this method of treatment is not always possible, and, where possible and practicable, not always successful in relieving the symptoms.

The aim and purpose of the other forms of treatment of mental conflicts resulting in functional mental disorders are the same, namely, to put the frontal lobes at rest. Fortunately there are other methods of doing this besides pre-frontal leucotomy. The great majority of mental conflicts are resolved by means of a little alcohol, a night's sleep, bromides or a change of environment.

Further efforts to curb the activities of the frontal lobes may be made by the administration of drugs of the narcotic group, such as somnifaine, and, where these are unsuccessful, coma-producing agencies, such as insulin, cardiazol and electrically induced convulsions. The success of these methods of treatment is due to the fact that the frontal lobe, which is the last part of the brain to appear, and the super-ego, which is concerned with the highest psychic functions, are the first to be affected, and, where unconsciousness supervenes, are the last to recover.

It is only when all these methods of medical treatment have failed, or have been deemed to be inapplicable to any particular case, and after having satisfied ourselves that the prospects of spontaneous recovery are so remote that they can be regarded, for practical purposes, as non-existent, that we should consider surgical

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intervention to sever, once and for all, the connections between the pathological frontal lobes and the thalamus.

The time that should elapse after the onset of illness before seeking surgical aid varies in each particular case. It is important, on the one hand, not to operate on anyone who is likely to respond to some less severe form of treatment. On the other hand, it is unfair both to the patient and to the surgeon to defer the operation until such a time as the personality has completely disintegrated. I have recently made it the practice for all patients who have been in the hospital for twelve months to be seen in conference by all the medical staff on the first Wednesday of every month. This has the advantage of bringing fresh minds to bear upon each individual case. I am not suggesting that no one should have a pre-frontal leucotomy until he has been twelve months in a mental hospital, but I do suggest that no one should be in a mental hospital for longer than twelve months without the possibility of his being relieved by pre-frontal leucotomy being considered.

To sum up, the indications for pre-frontal leucotomy are functional mental disorders with symptoms of active conflict which have failed to respond to other methods of treatment, and where the prospects of spontaneous recovery are remote.

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RESULTS OF PREFRONTAL LEUCOTOMY IN THIRTY CASES OF MENTAL DISORDER.

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WITH OBSERVATIONS ON SURGICAL TECHNIQUE.

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The purpose of this paper is to present the results of treatment by prefrontal leucotomy in 30 cases of mental disorder. In view of the fact that this procedure is not only comparatively new, and uncertain in its ultimate effects, but is also after all a destructive operation, its trial was only felt to be justified, in the first instance at any rate, in a selected number of chronic patients with an apparently hopeless or very poor prognosis.

Indications.—Reports from the literature led us to believe that cases showing disturbed behaviour or chronic depression with or without agitation might benefit from leucotomy. In fact our cases do, broadly speaking, fall into these two categories. Thus seven cases of involutional melancholia, five each of paraphrenia and dementia paranoides, six of schizophrenia (other forms), four of epilepsy, two of chronic mania and one of psychopathic personality were selected. With the exception of the melancholias all except one of the remaining cases showed marked disturbance of behaviour, such as aggressiveness, violent outbursts, hostility, quarrelsomeness, abnormal irritability, destructiveness or negativism. In the paranoid psychoses most of these disturbances were based on hallucinatory experiences or due to delusions. In the schizophrenics they were mostly irrational or impulsive in nature, and as regards epilepsy, four of the most difficult and troublesome patients were chosen. Altogether this group represented the type of cases who required a great deal of nursing supervision, who were a constant source of trouble, often unemployable, and in many instances regarded as dangerous.

The seven involutional melancholias were selected on account of their chronicity, continued agitation or marked suicidal tendencies, necessitating continual nursing supervision both by day and by night. The selection of two chronic manias needs no elucidation, whilst the case of psychopathic personality presented the features of uncontrolled aggressiveness, lability, screaming bouts, temper tantrums and hysterical manifestations.

It may be added that other forms of treatment (e.g. shock therapies, prolonged narcosis, occupation, prolonged sedation, etc.) had failed to allay the symptoms in many of these patients, or had only produced at best a very short-lasting remission. In any case, with the exception perhaps of the involutional melancholias, the general characteristic of the group as a whole was chronicity, as will be seen from Tables I and II. Prefrontal leucotomy was therefore performed in these 30 patients without mortality, more as a palliative measure than with any hope of cure.

Type of operation.—In 9 cases the Crombie type of operation was performed, the leucotome with rotating blade as devised at Warlingham Park being used.

In 5 cases the technique advocated by Freeman was carried out.

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In the remaining 16 cases a combination of the Crombie and Freeman techniques was used.

Time observed after operation.—In accordance with findings of other workers results recorded too soon after operation are generally unreliable. This seems to be due (*a*) to the effect generally of a surgical operation, with its concomitants of special individual attention, changed environment, etc. (*b*) To the development of transitory symptoms due to the leucotomy, e.g. drowsiness, excessive lethargy, disorientation and mild confusion with amnesia, which would obscure the basic and permanent symptoms. The patients usually take two or three months to become stabilized and for the true clinical picture to emerge, but this time varies with each case and with type of operation. Of the present series 24 cases have been observed for six months or longer (up to 14 months), and the remaining six from one month to five and a half months, three of them for less then three months. These latter are all regarded as " not improved " so far. More experience is required before one may be dogmatic as to what length of time should elapse before the clinical condition becomes stabilized. Our results are put forward very much with this reservation.

Recording and assessment of effects of leucotomy.—We would like to stress that the effects of leucotomy can really only be satisfactorily recorded by presenting the clinical history of each case in detail, both before and after operation. Psychiatric material does not readily lend itself to framing results by tabulation, and this instance is no exception. As the space at our disposal does not allow of this, some form of tabulation has been necessary, though we append descriptions of four cases that were particularly instructive.

Tables I and II give a general survey of the results obtained, together with duration of psychosis, length of time observed after leucotomy, and type of operation. " Much improved " indicates a striking and complete relief of the worst symptoms which were taken as indications for treatment, and leading to disappearance of psychomotor unrest, easing of tension or depression and a consequent lessening of the need for supervision and greater freedom for the patient. " Improved " indicates partial relief of these symptoms to such an extent that they were no longer

TABLE I.—*Results of Prefrontal Leucotomy in* 30 *Cases of Mental Disorder.*

Case number.	Sex and age.	Duration of psychosis up to time of operation.	Time observed after leucotomy.	Type of operation.	Result.
Involutional melancholia, 7 cases.					
1	F. 54	6 years	14 months	Crombie	Not improved.
3	F. 53	2 ,,	13½ ,,	,,	,,
6	M. 57	3½ ,,	12½ ,,	,,	Much improved.
15	F. 60	3½ ,,	9 ,,	Freeman and Crombie	Improved.
16	F. 61	2½ ,,	8½ ,,	,, ,,	Not improved.
18	F. 62	4 ,,	7½ ,,	,, ,,	Slightly improved.
23	F. 47	3½ ,,	6 ,,	Freeman	Much improved.
Paraphrenia, 5 cases.					
2	F. 50	8 ,,	12 ,,	Crombie	Temporary improvement.
5	M. 46	6 ,,	13 ,,	,,	Much improved.
9	F. 64	11 ,,	11½ ,,	Freeman	Improved.
19	F. 60	14 ,,	7½ ,,	Freeman and Crombie	Not improved.
24	F. 51	2½ ,,	6 ,,	Freeman type ½ cm. further posteriorly	Deteriorated. *Died* 3½ months after leucotomy.
Dementia paranoides, 5 cases.					
7	F. 45	13 years	12½ ,,	Crombie	Slightly improved.
8	F. 43	5 ,,	12 ,,	,,	Improved.
21	F. 45	6 ,,	28 weeks	Freeman	,,
25	F. 42	10 ,,	5½ months	Freeman type, ½ in. more posterior and Crombie	,,
29	F. 39	8 ,,	7 weeks	Freeman and Crombie	Not improved.

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TABLE II.

Case number.	Sex and age.	Duration of psychosis up to time of operation.	Time observed after leucotomy.	Type of operation.	Result.
Epilepsy (psychosis and oligophrenia), 4 cases.					
11	F. 38	7 years	10 months	Freeman and Crombie	Much improved.
12	F. 34	Congenital.	10 ,,	,, ,,	,, ,,
13	F. 43	18 years	9½ ,,	,, ,,	Improved.
14	M. 26	Congenital.	9 ,,	,, ,,	Much improved.
Other forms of schizophrenia, 6 cases (10 and 22 Catatonia).					
10	F. 26	10 years	10 months	Freeman and Crombie	Not improved,
22	F. 43	6 ,,	1 year	Freeman	Improved.
17	M. 36	10 ,,	8 months	Crombie	Not improved.
20	F. 41	24 ,,	7 ,,	Freeman and Crombie	Improved.
26	M. 29	6 ,,	6 ,,	,, ,,	Much improved.
27	F. 41	15 ,,	5 ,,	,, ,,	Improved.
Chronic mania, 2 cases.					
28	F. 45	7 years	3 ,,	,, ,,	Not improved.
30	F. 37	5 ,,	3 ,,	,, ,,	,, ,,
Psychopathic personality, 1 case.					
4	F. 26	Congenital.	13 ,,	Crombie	Slightly improved.

TABLE III.

	(a) Involl. melancholia, 7 cases.	(b) Paraphr. and demen. paranoid., 10 cases.	(c) Epilepsy, 4 cases.	(d) Schizophrenia, 6 cases.	(e) Chronic mania, 2 cases.	(f) Psychopathic Pers'y, 1 case.	(g) Total.
No longer depressed	3	..	..	..	..	..	3
Less depressed	1	..	..	..	..	..	1
Improvement in behaviour (i.e. no longer aggressive, violent or destructive)	..	7 (9) (1 temp.)	4 (4)	4 (6)	..	1 temp.	16 (2 temp.)
Loss of or marked diminution of agitation	4 (5)	..	..	..	..	..	4
Tension eased	..	4 (5)	..	..	..	1 temp.	5 (1 temp.)
Less irritable	..	..	4 (4)	2	..	..	6
Improved quality and output of work	4	1	3	4	..	1	13
Loss of initiative and spontaneity	2	9	1	..	2	..	14
Persistence of delusions and/or hallucinations	6 (6)	9	..	3 (3)	..	..	18
Developed volubility	(2 temp.)	..	1	..	..	..	3 (1 temp.)
No longer stuporose	..	..	..	2	..	..	2
Developed perseveration	5	3	..	2	..	..	10
,, retardation	..	3	..	3	1	..	7
,, emotional facility	5 (1 temp.)	7	3	4	..	..	19 (1 temp.)
,, euphoria	..	3	1	2	..	..	6
,, irritability and aggressiveness	4	..	..	..	..	(1 temp.)	5 (1 temp.)
Increased appetite	5	4	2	3	1	..	15
Loss of sphincter control	2 (1 temp.)	5 (3 temp.)	..	2 (1 temp.)	2 (1 temp.)	..	11 (6 temp.)
Developed epileptiform fits	..	1	..	..	..	..	1
Deteriorated and died	..	1	..	..	..	..	1

Temp. = temporary.

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such a disturbing influence in the ward or did not require the same amount of supervision, or where undesirable symptoms still remained but were of much less intensity. "Slight improvement" indicates amelioration in one or two symptoms (e.g. excitement or depression), but not of sufficient extent to change the clinical picture as a whole very much or to diminish the amount of supervision required.

Two distinct effects of leucotomy can easily be recognized: (*a*) the relief of undesirable symptoms, and (*b*) the production of new symptoms. These two groups of phenomena will combine so as to form the total resultant clinical picture. In Table III a number of the more striking symptoms have been analysed in each group of cases.

On the positive side there are the disappearance or lessening of depression in four out of seven melancholics, the improvement in conduct and behaviour of 16 of the remaining cases, and the improved quality and output of work (occupation therapy, farm work, etc.) in 13 cases, four of whom were consistently unemployable before leucotomy. Negative or undesirable results include loss of initiative and spontaneity, persistence of delusions or hallucinations, development of emotional facility or euphoria, of retardation, or perseveration, irritability and aggressiveness (in the melancholias) and volubility. The more physical sequelae included loss of sphincter control, development of voracious appetite, trophic disturbances such as greater predisposition to bed-sores and pressure-sores, and occurrence of epileptiform fits (one case only).

Some of these symptoms have been of a temporary character, and it may well be that others will gradually lessen as time goes on—our period of observation is as yet insufficient.

Table IV shows symptoms produced correlated with the types of operation. Our series is too small for too much significance to be attached to these figures. It is evidence *prima facie* however, that with the more extensive operation more symptoms are produced, e.g. mental symptoms which are very similar to those of the recognized organic psycho-syndrome, together with loss of sphincter control (permanent or temporary), voracious appetite and trophic disturbances. In Case 24 the Freeman technique was used, but the cut made further posteriorly. This patient subsequently displayed the features of an organic dementia, characterized by amnesia, confusion, marked euphoria with emotional facility and childishness. She became extremely noisy, restless and incontinent, and required frequent sedation. She eventually developed numerous bed-sores and died of exhaustion and toxaemia.

TABLE IV.

Type of operation.	Total number done.	Loss of initiative and spontaneity.	Developed retardation.	Developed emotional facility.	Developed euphoria.	Developed irritability and aggressiveness.	Increased appetite.	Loss of sphincter control.	Deteriorated and died.
C	9	4	1	3	..	2	5	..	..
C & F	15	8	4	10	2	3	7	6 (3 temp.)	..
F	4	1	..	4	2	..	3	3 (2 temp.)	..
F posterior	2	1	2	2	2	..	..	2 (1 temp.)	1

PSYCHOMETRIC INVESTIGATION.

It was hoped to test each patient before, six weeks and four months after operation with the following tests: Terman Vocabulary Test, the Revised Stanford Binet scale, the "Discrepancy Test" modification of Babcock's scale, Kohs' Blocks, Porteus Mazes, the Passalong Test, Progressive Matrices, and the Shipley-Hartford test. Practice effects were diminished where possible by applying forms L and M of the Stanford Binet and by reversing the designs and mazes at alternate sessions. Examinations will be continued at yearly intervals.

Only 14 patients out of 30 could be validly tested before operation and three of these could not be re-tested. One, our first case, became after treatment very suspicious of everything connected with the operation, including both tests and tester. The other two were the patients operated on with the Freeman technique ½ in. posteriorly. Both were too lethargic to test at either of the intended times. One of them has died. Whether cognitive potentialities have been irreparably

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destroyed in the other cannot be decided until the lethargy has sufficiently diminished to permit valid testing.

The planned programme was effected in 11 patients. One, in whom the Freeman operation was performed, showed, six weeks later, a pronounced fall in the discrepancy test, a fourfold increase in the time consumed by the vocabulary test, an increase of from ¾ of an hour to over 2½ hours spent on the matrices, and a large fall in the number of items attempted in the Shipley-Hartford scale. These defects were also mainly attributable to lethargy and lack of spontaneity. At times she almost fell asleep over her task. Four months after the operation she attained her pre-operative level.

In five patients the combined Freeman-Crombie technique was used. Only one showed definite change, and she, curiously enough, was the only patient among those examined in this group whose EEG was apparently unaffected. Six weeks after the operation her Stanford Binet score declined from M.A. 18 to M.A. 12·7, her Porteus score fell from 14½ to 8½, although she spent treble the time on it, and her matrices score fell from 32 to 21. Four months after the operation her matrices score had returned to its initial level, but the other changes largely persisted. In addition, the time spent on her vocabulary test, previously slightly increased, was now doubled. Most of her loss appeared to be caused by extreme inhibition and vacillation, which inexplicably contrasts with the mild but unrestrained outbursts of irritability she often now displays. Sometimes, however, she seemed to struggle without result and forgot the problem before an answer came. She also exhibited defects in the quality of performance, including perseveration and signs of impaired conceptualization. On analysing the Stanford Binet items into the six groups suggested by Roe and Shakow (1) her additional failures six weeks after the operation were found almost exclusively, in order of severity, in "sustained associative thought," "conceptual thinking," and "immediate learning." Four months after operation the additional failures were halved in the first of these groups, but remained in the other two. Vocabulary, remotely learned material other than vocabulary, and immediate associative thought were unaffected by the operation.

In the remaining five patients the Crombie method alone was used. None showed defects, although two had abnormal EEG's. One considerably improved her scores in a fashion correlated with clinical improvement. The diminished suspicion of another was reflected by a fall in the time spent over the matrices from nearly five to one hour. Later his suspicion somewhat returned, and he spent two and a half hours on this test.

Four conclusions are to be derived from these investigations. Firstly, since so many patients cannot be validly tested before operation, an individual worker can accumulate little data. Therefore it is desirable that all investigators should use at least a uniform minimum battery of tests. Secondly, it is clearly necessary before interpreting results in purely cognitive terms to evaluate the effect of disorders such as lethargy, lack of spontaneity, and attitude of suspicion. Thus, a scale such as Wittman's for rating test reactions should be employed. Thirdly, different operative techniques appear to have different effects. The Freeman technique ½ in. posteriorly certainly produces lethargy, but our present material is insufficient to warrant generalization about its effect on cognition. The combined Freeman and Crombie technique sometimes produces lethargy, and in one case has left signs, four months after the operation, commonly found in demented patients. The Crombie operation alone does not seem to produce either marked lethargy or any cognitive defect, so that the Freeman element must be held responsible for this. Finally, no relation has appeared between test performance and abnormal EEG.

Electroencephalography.—Of seven cases on whom an operation of the Crombie type had been done and whose EEG was obtained, only three showed marked changes during the days following the operation. In the same way eight cases were examined who had the Freeman and Crombie operation and one whose operation was of the Freeman type, and of these only one (No. 18) *failed* to show changes. *EEG photos.*—No. 1 shows a normal record for comparison. Nos. 2, 3 and 4 show the changes in Case 25: (2) immediately following the operation random delta waves almost continually; (3) after about ten days long-fasting frequent bursts of high-voltage waves originating in the frontal region; (4) after about three weeks these became very much less frequent. This is the case which

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had an epileptic fit, and records 3 and 4 are of the epileptic type. There has been only one other case so far who has shown anything comparable to this, and that is Case No. 26. He has not had an epileptic fit.

CASE 5.—Male, aged 46.
Diagnosis: Paraphrenia.
Duration of psychosis before leucotomy: 6 years or more.
Time observed after leucotomy: 13 months.

The history showed an insidious onset of the illness a couple of years prior to admission in November, 1937. There was a history of alcoholism from the age of 16 to 27. About twelve months before admission he started to express delusions openly, stating that he was subjected to persecution by the Post Office authorities by whom he was employed. On account of his delusions he got into trouble with the Post Office authorities, whom he accused of trying to hound him out of the service, and he stated that this plot against him had been going on for some considerable time. He was admitted in November, 1937, under certificate. He was suspicious and reserved in his attitude and very guarded in his replies to questions. In addition to the persecutory delusions he had auditory hallucinations, hearing voices giving him directions. Delusions of influence also began to appear, e.g. a few months after admission he believed that people were interfering with him at night. During his first admission his behaviour was fairly good and he managed to keep his delusions and hallucinations under reasonable control. On the application of his wife he was discharged relieved in June, 1938.

He was admitted for the second time under certificate in December, 1939. By this time the psychosis had developed considerably. He was now more suspicious and reserved, and his delusions were more numerous. Delusions against the Post Office authorities had been pressed into the background and now he expressed the delusion that his wife had been unfaithful because she was scared of some unknown persons, and that these persons had prevailed on her to have him certified. He thought that he was going to be held in hospital to be tortured every night, and that the medical staff were all against him. Hallucinations were not detectable at first, but these soon became apparent. The note in February, 1940, states that he complained of being sexually interfered with at night, and that he began complaining of voices which were saying obscene things to him. The hallucinations gradually became more pronounced, as a result of which he was frequently aggressive and violent towards other patients. By July, 1940, he had deteriorated. Auditory hallucinations were now very acute, and he had included his present environment in his persecutory delusions. He believed that he was being accused of filthy and abominable things by other patients, and that they were continually making references to him in obscene and vile terms, so much so that he complained to the medical officer that foul language was continually being directed at him, and he was afraid that unless he were away from the patients he would have to retaliate by striking them. His threatening attitude became more pronounced and his assaults on other patients more frequent. He was now tense and morose, but would still reveal his delusions and hallucinations to the M.O. at an interview. He was given a course of insulin therapy from December, 1940, to April, 1941, but without any improvement. As soon as he returned to his usual ward he became threatening, impulsive and violent, continually complaining of the foul language and false accusations that were being directed at him. "These remarks had an ugly and underhand meaning, purposing to make him a laughing stock of everybody." In February, 1942, his behaviour had still further deteriorated. He now maintained that he was being sexually interfered with at night, that people were systematically using filthy language to him and that he was being accused of the vilest crimes. "All these things put together," he said, "have such a paralysing effect on my life that they have undermined my physical health so that I am now quite unable to do anything, even to write letters to my wife." He stated that he dare not now tell the M.O. everything for fear of retribution. Violent attacks on other patients and on staff were frequent, and necessitated treatment in bed or continuous baths at various times. By the staff he was regarded as one of the most dangerous patients in the ward. This was his condition at the time when prefrontal leucotomy was performed on February 10, 1942.

During the first few days after the operation he was a little drowsy and very quiet. He would not talk very much and slept a great deal during the day. He ran a mild pyrexia for about 14 days after the operation. About a month after he was much improved physically. He smiled rather more than before, but did not talk (very much) spontaneously. He started becoming argumentative with the other patients, but if left alone would remain quiet and rather apathetic, at times smiling rather fatuously. On March 25 it was evident that his delusions were much the same as before, but as regards his hallucinations he said that he had hardly heard any foul language lately. Interviewed by the medical staff in April, 1942, he denied feeling better or different, and said that bad language was about the place all the time, but not as it was before. "They are not as forward as they were in their remarks to me," he said; "it is miles better than what it was." He was still in an observation ward. His behaviour, however, had been very good since the operation. There was no violence or aggressiveness, although at times he would adopt a threatening mien. On account of his good behaviour in the ward he was allowed grounds parole in May, 1942. He had become more solitary and apathetic and smiled much more fatuously. He would not employ himself, however, and his thought

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content remained exactly the same. He remained well behaved, and was later transferred to a better ward and out of observation at night. He was not now regarded as dangerous.

At the interview in February, 1943, he smiled a good deal, more than he used to do, in a facile and fatuous manner. He was somewhat retarded. He continued to express the same delusions of interference and persecution, but stated: "It is not as bad as it was. They used to challenge me to fight. I was forced to fight. I have not been challenged now and have not had a fight with anyone for over twelve months." He keeps reiterating "It is not nearly so bad as it used to be," and uses perseveration. He is now much more facile, laughs and smiles more readily, and appears to be altogether more amenable. The Charge Nurse of the ward reports: "His behaviour is very good. He is now much more pleasant; he has never attacked any patients since he had the operation, and is much easier to deal with." He has little interest or initiative, however. He never plays games, writes letters or goes to any of the entertainments. His only occupations are to make his own bed, clean out his room and occasionally to read the newspaper.

Summary.—Marked improvement in behaviour. Thought content and hallucinosis unchanged. More retarded and more facile. Displays less initiative and spontaneity.

Case 6.—Male, aged 57.
Diagnosis: Agitated involutional melancholia.
Duration of psychoses before leucotomy: Over 3 years.
Time observed after leucotomy: 13 months.

On admission he presented a picture of severe agitated melancholia. He was extremely apprehensive, restless and agitated, wringing his hands and reiterating, "You promised me you would spare my life. I will do anything: let me stay here all my life, so long as my children can come and see me," etc. He was very self-accusatory and blamed himself for his breakdown. On account of the previous history he was regarded as acutely suicidal. He continued to be extremely agitated and restless, also at times aggressive and actively suicidal, and was full of auto-accusatory ideas. He was continually begging to be allowed to stay in hospital. He continued in a similar condition in spite of two courses of prolonged narcosis, and did not improve. In June, 1939, he expressed the delusion that he was going to be taken away and chopped up, and his one fear was of leaving hospital. He continued to be very aggressive as well as suicidal, and had to have continuous bath treatment. In July, 1939, he began to cause a great deal of trouble, continually trying to break windows in order to escape. For the next two months he was alternately in the continuous bath or under prolonged narcosis. In November, 1939, he was still very depressed and continually begging not to be sent away, but at the same time impulsively violent, striking other patients and smashing windows. He was now becoming dangerous, suicidal and destructive, and was a great source of trouble in the ward. He was sustaining injuries almost daily, either through attempting to smash windows or trying to escape, and required constant nursing supervision the whole time. He also made several attempts at escape, although he kept reiterating that he did not want to leave hospital. He had gradually become one of the most troublesome patients in the ward, and it had become increasingly difficult to look after him, as one could not leave him even for a minute. This was his condition when prefrontal leucotomy was performed in February, 1942.

The post-operative course was fairly uneventful. He became very quiet, smiled and lost his agitation. About three weeks after operation spontaneously said that he wanted to go home. When interviewed by the medical staff in April, 1942, he said he was quieter and did not worry as much as he used to do. He admitted his violent and suicidal behaviour in the past, but said he felt better in that respect. He still heard voices at times, and said he felt depressed because he did not know what the doctors might do to him. He only wanted to do as he was told. Apparently greatly improved although he was still somewhat depressed, but showed in addition marked emotional facility. This condition has persisted. In February, 1943, he has maintained his improvement; he has been in a non-observation ward since August, 1942, and gives no trouble at all. When interviewed: What difference do you notice since the operation? "I feel very, very quiet, a kind of tame feeling. I do feel ever so much better." How do you feel in your spirits now? "I am contented. I feel quite happy. I am not worrying at all." (He then laughs.) "I want to stay here. I don't want to go out. I am quite happy here."

Objectively he appeared more facile and there was no sign of any depression or agitation, although he still expressed vague ideas of unworthiness and guilt regarding his past life. The Charge Nurse of the ward who had known him both before and after the operation reported: "He is a different man altogether. He is very quiet now. He will do ward work and will join in with games, particularly billiards and draughts, at which he is very good. He will also come and ask for jobs if he has nothing to do. He has one big worry. He is afraid of being sent home, and is afraid of being a nuisance as well."

Summary.—Marked all-round improvement. Thought content essentially the same. Some increase in emotional facility. No objective signs of depression. Agitation and psychomotor unrest completely disappeared. A little more retarded in thought.

Case 25.—Female, aged 42.
Diagnosis: Dementia paranoides.

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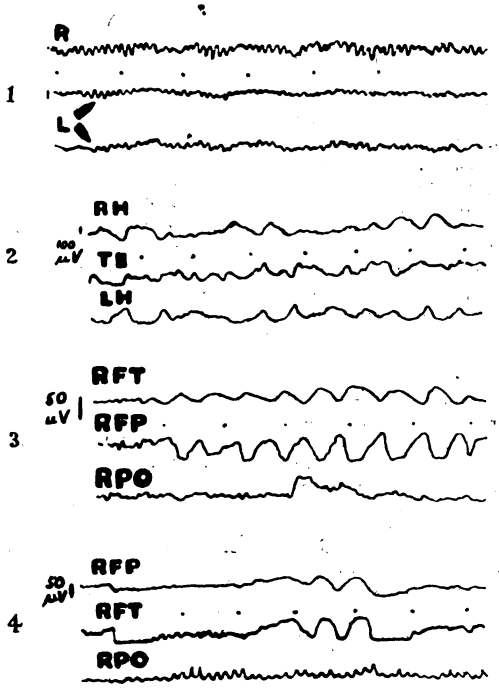
Duration of psychosis before operation: 10½ years.
Time observed since leucotomy: 6 months.

The history showed an insidious onset over a course of seven years before admission, starting with ideas of reference and eventually delusions of persecution and influence. These were directed against the neighbours, whom she accused of listening to her conversation through the electric lights at night, of maligning her and alienating her husband from her. She kept these delusions fairly well under control for some years, but eventually, following a fight with a woman neighbour, she was summoned and bound over. Subsequently she became very abusive to the police and was admitted to hospital under certificate in August, 1938. She was dissociated and disconnected in her conversation, displayed various mannerisms, and incongruity of affect and thought content. She was hostile and abusive and expressed various delusions of persecution at the hands of her neighbours, whom she accused of being jealous of her. Various other bizarre delusions of influence and persecution were much in evidence. With the exception of



No. 1.—Normal record.
No. 2.—Case No. 25—one day after leucotomy.
No. 3.—Case No. 25—10 days after leucotomy.
No. 4.—Case No. 25—3 weeks after leucotomy.

a few months at home in 1939, when she left hospital against advice, she did not alter during the succeeding two years. Then she began to show deterioration, was extremely hostile and aggressive. She now included her present environment in her delusions and was particularly deluded against the staff. She expressed numerous delusions of influence as a result of which, she stated, she had been changed, and that the staff had taken advantage of her. She also had auditory hallucinations. As a result of the delusions and hallucinations she was frequently violent, e.g. she once knocked a nurse unconscious for ten minutes. From this time onwards she was very threatening and aggressive, frequently fighting with other patients as well as staff. She showed much intrapsychic ataxia. Emotional flattening was present, but her prevailing mood was one of sullen hostility. She was mostly very tense and suspicious. Thought content was unchanged. A few months prior to leucotomy she frequently became extremely noisy as well as aggressive and violent, causing a good deal of trouble, and requiring constant nursing supervision.

Prefrontal leucotomy was performed on September 21, 1942, using a modified Freeman technique ½ cm. further posteriorly, and also Crombie operation. For the first five days after the operation she remained very drowsy. She appeared somewhat confused and disorientated and did not seem to realize at first that she had had an operation. Even at this early stage she admitted that the voices were continually talking to her and that they still worried her. She said this with very little sign of affect. She appeared in fact apathetic and was retarded in her speech. Her habits had deteriorated. She was now incontinent of urine and faeces. A week

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after the operation she was not so sleepy but was lazy and lethargic. She seemed apathetic about everything, and was highly suggestible. She showed perseveration and was disorientated for time. She was still incontinent. A month after operation she seemed brighter; showed little spontaneity, though when stimulated did not appear to be so slow. Hallucinations and delusions of influence were still present, but she stated they did not worry her so much. She was still apathetic and quiet. Post-operative confusion seemed to be clearing up. She was still incontinent. Her condition remained practically unchanged for the next two months. On January 11, 1943, she had an epileptic fit. She had never had one previously, and presumably this fit was due to the leucotomy. There have been no other fits since.

At the end of February, 1943, 5½ months after operation, when interviewed again she stated she felt much better. "I really think the operation on my head has had a lot to do with it. Friction is not so vivid really." She perseverates and repeats this sentence several times during the interrogation: "I feel much better; it certainly was very bad, but it is not so vivid now." "I have just got to carry on, put my worries aside and do the best I can." Objectively she appears very bright and contented and has entirely lost the morose and sullen expression, and her attitude is no longer suspicious. She smiles rather more fatuously than before, and emotional facility seems to be in evidence. She is more retarded and displays much less interest and initiative. The Sister of the ward reports: "She is very pleasant indeed. She is somewhat slow but will do odd jobs if asked. She writes sensible letters home." She is now no longer faulty in habits even without supervision, and gives very little trouble.

Summary.—Marked improvement in behaviour. Delusions and hallucinations much less prominent. Increased indifference of patient towards her own thought content, resulting in a calm attitude. She displays less initiative and interest, is more retarded, and emotionally more facile.

CASE 14.—Male, aged 27.

Diagnosis: Epileptic feeble-minded.

Time observed after operation: 9 months.

There was a history of onset of epilepsy in childhood. He was never employed, was backward at school and was most difficult to handle at home. He received out-patient treatment for many years and lived at home. He was admitted to hospital in February, 1942. His behaviour was extremely aggressive, and during the first week in hospital he was violent, striking at the nurses and the medical officer. He was irritable, suspicious and egocentric, and displayed the typical epileptic temperament. He was continually grumbling, was easily upset and would then strike out at any one. He proved a most uncontrolled patient, and after a time he showed himself one of the most difficult epileptics in the hospital. He had frequent outbursts of temper. He was childish and self-centred and very quarrelsome and argumentative, and would use obscene language without provocation. He frequently refused food to cause trouble for the nursing staff. There would be phases lasting a few days when he would be quieter and more controlled. After the first two months of his admission he had no more fits, which were apparently controlled by luminal and epanutin. His behaviour, however, remained very difficult. He required constant nursing supervision and was nursed in the disturbed ward.

Prefrontal leucotomy was carried out on June 2, 1942. During the first week after operation he had a mild pyrexia. He seemed apathetic, taking no interest at all, and was rather drowsy. He seemed very slow in response to questions and was particularly slow in eating his food, sometimes taking an hour and a half over a meal. Ten days after operation he seemed less drowsy. He was more pleasant and amenable, and showed no irritability. A month after operation he had maintained his improvement. He was now much more sociable. He had no outbursts of temper or violence, though at times he would still be argumentative and somewhat noisy. In September, 1942, at a medical conference he denied feeling any different after operation, but objectively he appeared steadier, more friendly and much less irritable. For three and a half months following leucotomy he had shown no aggressiveness and had not been threatening. The nurse accompanying the farm patients said he was much more stable and gave him a very good report. When he had worked on the farm before he had leucotomy he had threatened both the nurse and other patients with a spade, and had been difficult and cantankerous. In February, 1943, he still denied feeling different after the operation, but said he had not been excitable for a long time. He still displays the epileptic temperament, but appears much more chastened and is just a little querulous and self-centred. He is now in a better ward and enjoys the privilege of ground parole. The nursing staff who have known him before and after state that he is very much improved. He never strikes out now at anyone and is not regarded as dangerous. He works quite well on the farm and causes no trouble. He has a voracious appetite. He is much easier to handle.

Summary.—Marked improvement in behaviour. Somewhat more retarded. Irritability much less. Appears more contented and is a little facile.

Summary and conclusions.—On the basis of results of treatment by prefrontal leucotomy in 30 chronic cases of mental disorder it has been possible to substantiate that certain very disturbing mental symptoms may be alleviated in about half the total number treated. The question of the permanence of the relief of such symp-

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toms must, as far as we are concerned, still remain *sub judice*, i.e. until a reasonable length of time has elapsed, after which any chance of relapse can be regarded as very remote. The *modus operandi* of such therapeutic effect will no doubt be the subject of much discussion and occasion many interesting hypotheses, both psychological and neurophysiological. It is not possible for us to put forward any working hypothesis, except that one may reasonably say that the important changes take place in the conative-affective sphere and not in the cognitive. In delusional, hallucinatory and tension states there appears to have arisen in those who responded well an indifference, even apathy, on the part of the patient towards his psychotic thought content, resulting in a calmer attitude and consequent abolition or lessening of psychomotor unrest and an improvement in behaviour. In the successfully treated depressive states the action is similar, viz. easing of tension with consequent loss of agitation and depression. It is reasonable to suppose that the relief of such unpleasant affective states and distressing conflicts is associated with the severance of the connection between the prefrontal area and the thalamus—but here histological confirmation is required. The thought content undergoes little change. In all the relevant cases except one the delusions and hallucinations persisted, though they often seemed less obtrusive and more shadowy than formerly.

TABLE V.—*Summary of Results in* 30 *Cases.*

Diagnosis.	Much improved.	Improved.	Slightly (or temp'ly) improved.	Not improved.	Deteriorated and died.	Total.
Involutional melancholia	2	1	1	3	0	7
Paraphrenia	1	1	1	1	1	5
Dementia paralytica	0	3	1	1	0	5
Schizophrenia (other types)	1	3	0	2	0	6
Epilepsy	3	1	0	0	0	4
Chronic mania	0	0	0	2	0	2
Psychopathic personality	0	0	1	0	0	1
Total	7	9	4	9	1	30

The final summarizing figures are given in Table V. After having studied the effect of prefrontal leucotomy in 30 chronic psychotics, our impression is that the best results are obtained in patients with severe disturbance of behaviour, such as excitement, aggressiveness, violence and destructiveness. The improvements achieved have been of practical importance. Patients with a disturbing influence have become quiet and easily manageable, thus obviating the need for the same close nursing supervision as formerly, and the output and quality of the patients' work has improved. In the involutional melancholias the results are a little disappointing. Patients showing tension and agitation seemed to derive the greatest benefit, whilst the chronic retarded depressive showed less change. We are of the opinion that prefrontal leucotomy is of benefit in the chronic type of psychotic patient described, but in view of the risk of producing undesirable new symptoms, both mental and physical, the operation should only be undertaken when all other methods of treatment have failed, and where it can reasonably be assumed that the chances of remission or recovery are very remote. In other words one must strike the happy mean between relief of distressing symptoms and sacrifice of frontal lobe.

OBSERVATIONS ON SURGICAL TECHNIQUE.

By G. C. KNIGHT, F.R.C.S.

Prefrontal leucotomy consists essentially of the division of the central core of white matter within the frontal lobes with a minimum disturbance of the cortex and subcortical tissues. It is an intervention based upon theoretical considerations, empirically designed to sever the connections of the frontal cortex, and especially, it is said, to interrupt the projections connecting the frontal regions with the thalamus and hypothalamus. Apart from this hypothetical design it is lacking in precise objective, for we have as yet no knowledge whether division of one set of fibres within the frontal lobe is of greater significance than another in producing the altered behaviour that is observed.

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Almost certainly the operation should be performed bilaterally, but the necessity for this lacks absolute proof. The cortical plane of section is of primary importance. The site of election at present accepted is that the fibres should be divided at a point 3 cm. behind the outer angle of the eye, the division being effected in the plane of the coronal suture.

There is evidence from the published reports (2), and from our present series, that the total effect produced varies with the antero-posterior location of the cut. Incisions that are spaced further anteriorly than at the point described produce less change in behaviour and are less effective as a means of lowering tension, dementia and psychomotor activity. Those that are sited further posteriorly are attended with undesirable changes—loss of initiative and spontaneity, corresponding to the organic psychosyndrome and amounting in extreme cases to dementia. Since Moniz (3) introduced the method numerous modifications of technique have

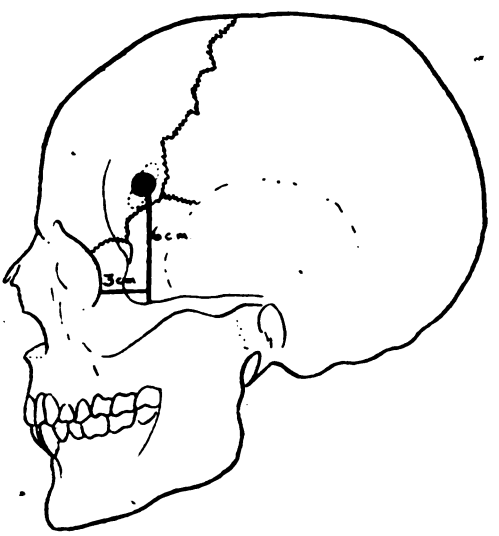

FIG. 1.—Illustrates the usual method of approach. A trephine hole is fashioned 3 cm. behind the outer angle of the eye and 6 cm. above the zygoma. This point is immediately anterior to the junction of the coronal and temporal sutures. The dotted line around the trephine hole indicates the upward and downward extension of this aperture, made for reasons of improved access in the course of operation.

been devised in order to secure division of the fibres. The multiplicity of the available measures suggests that there is no particular virtue in one method rather than another. Moniz approached the lobe by trephine openings situated 3 cm. from the mid-line, on the line of the coronal suture; in the first he destroyed the intrafrontal white matter by alcohol injections, later by the cutting of multiple cores of tissue within the frontal lobe formed by rotating by a loop of steel which expanded after insertion into the brain. Freeman and Watts (4) approached the lobe from the side at a point 3 cm. behind the outer canthus and 6 cm. above the zygoma, a cut being made in the coronal plane with a blunt knife, guarded against too deep an entry and turned through an arc with its centre at the surface. McGregor and Crombie (5) have devised an instrument with a rotating blade which cuts a circle 3 cm. in diameter. This instrument is introduced through a trephine hole situated at a point 3 cm. behind the eye and 5 cm. above the zygoma, a cut being made in this case also in the coronal plane with the instrument adjusted so that the blade shall lie in the centre of the lobe. Lyerly's (6) open method is fundamentally sound, and attractive to those who abhor the dangers of a blind procedure. By this method a small, rectangular osteoplastic flap is resected over the lobe and the fibres divided under direct vision. This is obviously a more formidable procedure than the simple closed methods outlined above.

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TABLE VII.—*Results of Mental Tests in Prefrontal Leucotomy.*

Serial No. (operation).	Terman Vocab. M.A. (Time in mins.)			Stanford-Binet (1937–L) M.A. (Time in mins.)			Discrep. Test M.A. (Time in mins.)			Discrep. score.			Kohs M.A. (Time in mins.)			Porteus M.A. (Time in mins.)		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
2	19	19	18	19–3	18–8	18–7	15	19	19–6	8	+1	+5	16–8	15–7	16–9	14½	15½	12½
(C.)	(20)	(13)	(10)	(105)	(100)	(90)	(20)	(16)	(18)				(35)	(35)	(28)	(10)	(7)	(10)
4	15	16	16	15–5	15–11	16–7	12–6	14–0	14–0	15	10	10	16–2	16–3	19–7	14½	14	12
(C.)	(6)	(5)	(4)	(130)	(115)	(130)	(18)	(18)	(15)				(30)	(28)	(25)	(10)	(13)	(15)
5	16	15	17	16–0	16–2	15–1	14–6	14–6	14–0	6	3	12	14–7	18–9	19–1	14	12½	16
(C.)	(13)	(12)	(10)	(165)	(110)	(120)	(20)	(30)	(20)				(25)	(28)	(20)	(10)	(20)	(12)
7	15	16	16	10–2	13–6	13–8	11–0	13–0	11–0	22	15	24	10–8	12–10	12–5	6½	11½	14½
(C.)	(8)	(18)	(10)	(150)	(100)	(105)	(20)	(18)	(25)				(35)	(20)	(30)	(35)	(15)	(2)
8	17	17	18	16–5	16–10	17–5	14–6	18–0	18–0	9	+1	0	12–9	14–3	14–5	12	14	15
(C.)	(15)	(10)	(12)	(145)	(115)	(100)	(20)	(20)	(18)				(40)	(38)	(35)	(15)	(9)	(12)
11	15	15	15	15–9	14–10	16–6	10–9	10–0	12–6	27	35	15	11–5	10–3	14–0	11½	11	10½
(F. & C.)	(10)	(7)	(5)	(120)	(115)	(110)	(30)	(30)	(30)				(30)	(25)	(45)	(17)	(20)	(14)
12	11	11	12	10–6	11–0	10–10	9–3	10–9	11–0	21	14	9	12–4	11–5	11–10	13	12	13½
(F. & C.)	(8)	(17)	(15)	(115)	(120)	(75)	(23)	(23)	(18)				(20)	(23)	(25)	(22)	(14)	(15)
13	15	15	15	11–6	11–8	11–3	10–6	9–8	10–0	27	33	28	8–9	9–0	9–0	6½	8	8
(F. & C.)	(10)	(8)	(15)	(130)	(110)	(120)	(23)	(25)	(17)				(25)	(20)	(18)	(25)	(30)	(35)
14	12	12	11	12–6	11–6	13–8	12–0	11–6	13–0	0	6	+15	13–2	13–8	12–4	13	15½	12
(F. & C.)	(12)	(10)	(10)	(135)	(110)	(110)	(20)	(19)	(17)				(26)	(35)	(32)	(16)	(12)	(12)
18	17	17	17	18–0	12–7	13–7	13–0	12–6	11–0	15	19	25	11–7	11–0	10–8	14½	8½	11
(F. & C.)	(15)	(20)	(30)	(145)	(185)	(170)	(21)	(25)	(20)				(30)	(28)	(33)	(15)	(45)	(48)
21	15	13	15	10–0	9–4	11–10	10–0	7–6	10–0	32	44	30	11–1	13–4	13–4	12	11	9
(F.)	(5)	(23)	(12)	(115)	(130)	(135)	(17)	(30)	(22)				(30)	(40)	(23)	(12)	(15)	(15)

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Serial No. (operation).	Passalong M.A. (Time in mins.)			Shipley Vocab. M.A. (Items attempted.)			Shipley abstraction M.A. (Items attempted.)			Shipley Total M.A. (Concept. quot.)			Matrices score. (Time in mins.)		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
2 (C.)	13–10 (18)	15–10 (20)	18–0 (18)	18–2 (40)	18–6 (40)	18–6 (37)	16–5 (20)	17–3 (19)	21–0 (20)	17–7 (93)	18–0 (97)	19–6 (117)	48 (50)	51 (23)	51 (40)
4 (C.)	12–10 (18)	15–6 (20)	14–0 (15)	13–9 (26)	14–7 (30)	14–3 (37)	13–0 (12)	13–6 (13)	14–2 (14)	13–5 (93)	14–3 (91)	14–5 (98)	47 (185)	48 (190)	43 (105)
5 (C.)	14–2 (18)	15–0 (17)	13–8 (25)	17–0 (37)	13–9 (30)	16–2 (40)	13–6 (13)	14–2 (14)	14–2 (14)	15–7 (80)	14–3 (101)	15–5 (87)	43 (285)	44 (60)	44 (150)
7 (C.)	9–3 (20)	15–4 (23)	18–9 (15)	14–7 (24)	15–9 (31)	16–2 (40)	9–9 (9)	12–0 (18)	13–6 (20)	11–5 (66)	13–7 (75)	15–1 (83)	12 (35)	34 (30)	41 (40)
8 (C.)	8–3 (20)	9–8 (25)	14–6 (23)	17–4 (40)	16–2 (40)	17–4 (40)	13–6 (13)	14–2 (20)	14–2 (16)	15–7 (78)	15–5 (87)	17–4 (81)	40 (150)	47 (75)	35 (140)
11 (F. & C.)	12–0 (20)	10–0 (16)	11–6 (19)	16–6 (40)	15–5 (39)	15–1 (32)	12–5 (16)	13–6 (14)	12–5 (17)	14–5 (75)	14–7 (87)	13–7 (81)	41 (40)	39 (35)	43 (30)
12 (F. & C.)	10–4 (25)	17–0 (16)	16–2 (20)	11–1 (12)	<9–5 (26)	10–7 (21)	9–9 (7)	9–4 (8)	9–9 (9)	10–0 (90)	8–7 (*)	9–9 (*)	29 (45)	29 (45)	26 (30)
13 (F. & C.)	9–8 (18)	9–10 (12)	9–3 (18)	15–1 (40)	15–1 (40)	12–7 (29)	11–5 (20)	12–5 (20)	9–9 (18)	12–9 (73)	12–5 (72)	12–7 (58)	19 (75)	18 (50)	22 (70)
14 (F. & C.)	12–3 (20)	13–8 (18)	16–8 (17)	12–3 (27)	13–5 (40)	12–3 (36)	13–6 (20)	11–5 (20)	13–6 (20)	13–1 (109)	12–1 (85)	13–1 (109)	45 (90)	42 (55)	46 (50)
18 (F. & C.)	13–3 (15)	10–0 (15)	12–0 (14)	16–2 (29)	14–7 (27)	14–7 (40)	11–0 (14)	12–0 (13)	12–0 (11)	13–1 (67)	13–1 (80)	13–1 (80)	32 (50)	21 (75)	37 (90)
21 (F.)	15–4 (22)	14–3 (18)	16–10 (18)	15–1 (24)	9–5 (3)	12–3 (40)	10–5 (19)	9–9 (14)	9–9 (20)	12–1 (68)	9–4 (*)	10–6 (79)	17 (45)	19 (155)	32 (30)

Notes : C. = Crombie operation.
F. & C. = Combined Freeman and Crombie operation.
F. = Freeman operation.

1 = Before operation.
2 = 6 weeks after operation.
3 = 4 months after operation.

* = Unreliable.

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Which of these methods will be selected is a question of individual surgical preference, and of secondary importance. The variations in technique are largely the results of an effort to avoid immediate or post-operative haemorrhage. That is the chief danger of this operation; a mortality arising from this cause is not unusual in the various published series. But haemorrhage can be avoided, in the closed methods, if certain simple precautions are taken. The dividing instrument must be blunt, and it must be used in such a way that it does not damage hidden vessels in the depths of the white matter, or those—including the anterior cerebral artery—which are situated upon the inner aspect of the frontal lobe. Cortical

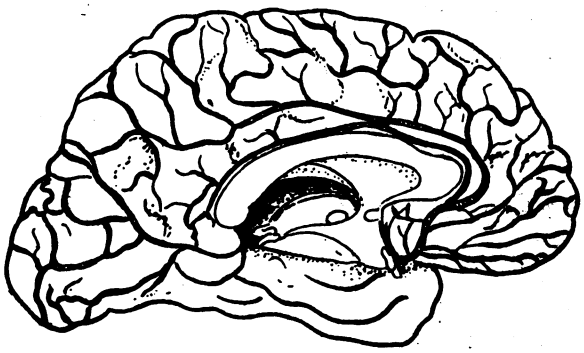

FIG. 2.—The anterior cerebral artery and its branches.

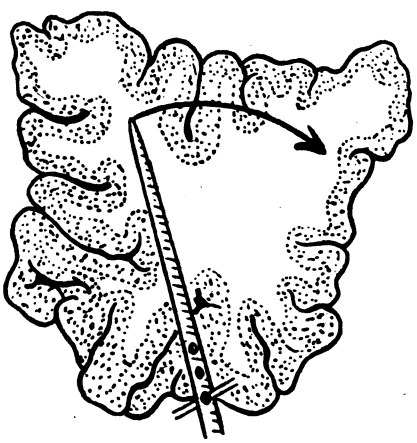

FIG. 3.—Illustrates a source of haemorrhage in frontal leucotomy. A leucotome that is passing safely through the white matter comes in contact with a vessel lying deeply within a sulcus on the inner aspect of the lobe.

vessels in this situation that lie in the depths of a sulcus may be in the line of traverse of a blade that is passing downwards through the white matter from above. The resistance of these vessels can be felt by experienced hands, and when encountered, the blunt instrument should be withdrawn and re-inserted at a slightly lower angle, so as to pass beyond the vessel before the section is completed.

Using this method we have so far operated upon 35 cases without a single post-operative haemorrhage or fatality.

Provided that this precaution is taken, it matters not one iota whether the division is effected by the open or closed method, or what particular instrument is used. Individual surgeons will continue to devise new measures that suit their individual prejudice, but advance will come more largely now from an interpretation of the clinical effect of sections of different amplitude and situation, rather than from the continued improvization of unimportant variations in technique. We lack

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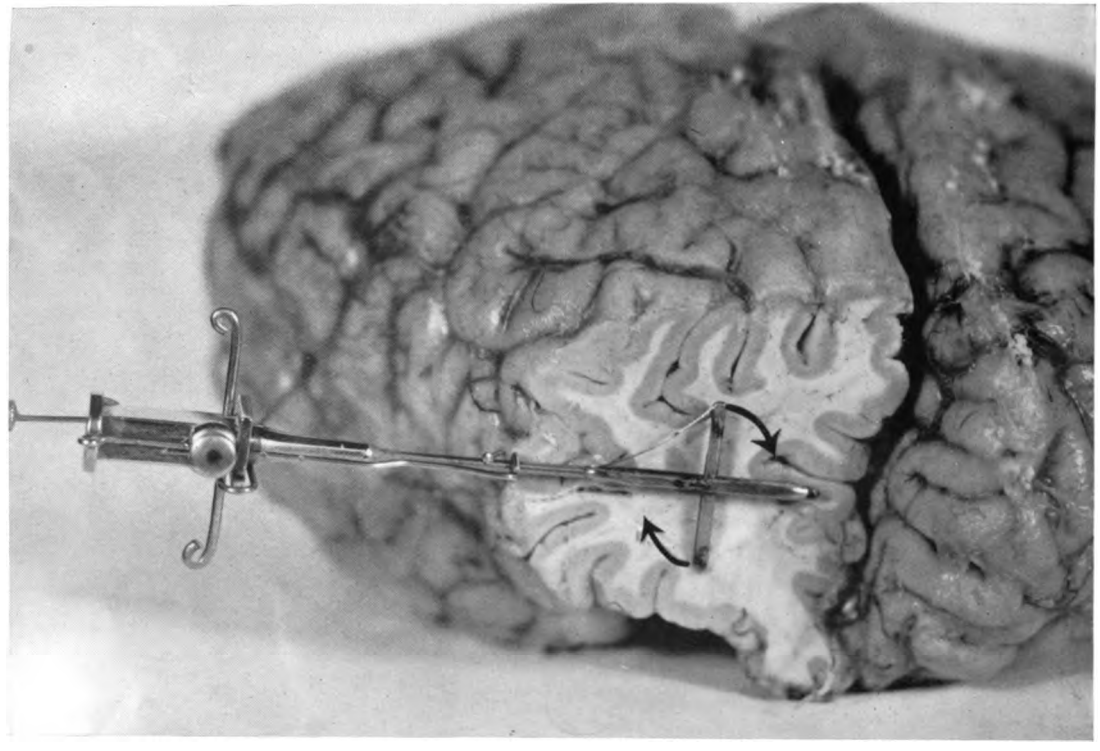

FIG. 4.—Section of a normal brain showing an early model of the Crombie leucotome in position. The stop that prevents too deep a penetration is readily identified. It will be seen that the traversing blade, even in this guarded model, may easily catch a vessel at the point marked by an arrow. The arc that is cut by the instrument only includes the immediate central core of white matter.

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sufficient evidence on this point, and it appears to be the duty of the neurosurgeon, at this relatively early stage in the investigations, to produce this evidence; for in a destructive operation such as this, the question that still requires to be established is how little do we need to divide in order to produce the required effect.

In the present series an attempt has been made to establish any significant difference in effect produced by certain of the operations commonly employed, and as between sections fashioned at various planes.

Prefrontal leucotomy may be readily conducted under local anaesthesia, but since our cases have consisted of the most violent, aggressive and dangerous patients in the hospital, general anaesthesia has so far been employed in all without exception. In the first cases of the series we naturally selected the operation which appeared from published accounts to produce the desired effect with the least possible disturbance of tissue. Fibres were therefore divided by the Crombie rotating blade.

Technique.—The anterior half of the head is shaved as far back as a line passing vertically upwards from behind the ear. A spirit dressing is applied to the scalp on the night preceding operation. The patient lies on his back, his chin flexed upon his chest, the head being supported in a rest. A point on the vertex 14 cm. from the nasion indicates the superior extremity of the coronal suture. This point is marked. The situation of the trephine hole is marked upon the scalp by a rectangular template in which a hole has been cut 3 cm. from one edge and 6 cm. from another. This is applied so that it is in contact with the zygoma and outer margin of the orbit. The line of incision, 4 cm. long, extending in the plane of the coronal suture, is then infiltrated with one in a hundred thousand adrenalin in normal saline, injected into the sub-aponeurotic plane. The scalp is divided, the bleeding points secured, and a self-retaining retractor inserted. The temporal muscle is incised in the line of the incision and separated superiorly from the temporal crest, thus exposing the point of juncture of the coronal and temporal sutures. A trephine hole is fashioned with burrs, or hand-trephined, at the required situation bilaterally.

When both are formed, the brain width at this level is measured by a pelvimeter. Commonly, the width is constant at 10·5 cm., each frontal lobe being approximately 5¼ cm. thick. The Crombie leucotome is now adjusted so that the blade shall lie in the centre of the lobe; the stop that prevents too deep a penetration into the brain is set at 4¼ cm. A hollow ventricular needle is now passed into the brain substance and aspirated to ensure that the anterior horn of the ventricle will not be entered. The leucotome is inserted transversely across the head, care being taken that it does not project posteriorly or downwards. It is turned so that the blade will cut into the plane of the coronal suture, and now—either by a screw mechanism or by a wire pull, according to the variations in the individual model—the guarded blade is caused to rotate. The instrument is then withdrawn, but in a small proportion of cases it will be found that it fails to move easily. In these cases a vessel has been caught between the blade and shaft of the instrument and will be torn if any force is employed. If this resistance is encountered, the blade must be set back into its original position, and the instrument will then withdraw freely without haemorrhage.

This operation was performed initially in nine cases, but we noted that in two cases of paraphrenia there was a gradual return of hallucinations and irritability. Although the patient was greatly improved, the final picture was far less favourable than that observed in the immediate post-operative period. It seemed that in the immediate post-operative phase the effects of division of the central core of white matter were accentuated by oedema in the adjacent areas of the brain, and at this time there had been complete relief of all symptoms. As the post-operative oedema absorbed, the hallucinations appeared to return. We therefore considered that a greater section, which divided the fibres further out within the lobe that are not reached by the Crombie blade, might give a more favourable and lasting result. For this purpose we adopted the Freeman technique.

The initial steps of this method are precisely similar to those of the Crombie operation, but after the trephine hole has been fashioned, the opening requires to be enlarged with biting forceps upwards and downwards in the plane of the coronal suture, in order to allow rotation of the leucotome that is now introduced. The dura is opened, surface vessels coagulated or otherwise avoided, and a blunt leucotome inserted strictly transversely. Thus may too deep a penetration be guarded

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against by means of a transverse bar that comes in contact with the skull; but with practice it is possible to guide the instrument in safety without this device, which may carry the point too far away from the side of the falx. The handle of the blade is depressed, carrying the point upwards within the lobe in the plane of the coronal suture. When the upper fibres of the lobe have been divided, the handle is raised almost vertically in order completely to transect the lowest fibres of the lobe. To give access to these it is essential that the incisions should have been extended somewhat upwards towards the convexity, to allow the handle to be sufficiently rotated. If any resistance is encountered during this traverse, it should be regarded as due to contact with a vessel, and the blade should be gently withdrawn a sufficient distance to avoid the block and then reinserted and the section continued.

Lately it has been our practice to make the Crombie section first, then complete the division of the peripheral fibres with a blunt leucotome. By this method one feels the arteries in the depths more readily, although the total effect of section is no different from that of the simple Freeman technique.

As a further experiment, we have, in two cases in which it appeared that the very maximum effect was needed, performed sections at a point half to one centimetre further back than the site of election. This posterior section is most harmful and should never be employed. It is attended by loss of initiative and spontaneity, by loss of sphincter control, by retardation and euphoria, and by a peculiar tendency to trophic ulceration of the skin. One patient so treated made a good recovery, but another deteriorated and died three months after operation—the only fatality in the series.

TABLE VI.—*Thirty-one Cases.*

Post-operative change.	Type of operation. Crombie.	Crombie and Freeman.	Freeman.	Freeman posterior.
Improved behaviour	3 (2 temp.)	9	3	1
Improved quality and output	2	7	3	0
Loss of initiative and spontaneity	4	7	1	3
Developed volubility	0	1	2	0
,, perseveration	3	4	1	1
,, emotional facility	3	10	4	2
,, irritability and aggressiveness	2	3	0	0
,, increased appetite	5	7	3	0
,, loss of sphincter control	0	4 (2 temp.)	3 (1 temp.)	2 (1 temp.)
,, retardation	0	4	1	2
,, euphoria	0	2	1	2
,, trophic ulcers	0	0	0	2
Deteriorated and died	0	0	0	1
Abnormal EEG	3 out of 7	7 out of 8		—

When we attempt to evaluate the relative effect of the Crombie and Freeman operations, my impression has been that the results of the Freeman operation are more permanent. No case of temporary improvement has been observed; in fact, improvement following this operation tends to be progressive and to continue over a period of six months or more; but the procedure is more extensive, as evidenced by the occasional occurrence of loss of sphincter control, the occasional development of retardation and euphoria, and the abnormal electroencephalogram that is almost invariably observed (see Table). These features are not seen in the Crombie type of operation.

There is therefore some evidence of quantitative difference in effect, dependent upon the number of fibres that are sectioned. It may well be that we should deliberately select the operation of one or other type, grading our section according to the individual requirements of any given case. Loss of initiative and spontaneity, for example, represent a distinct improvement and a most welcome change in cases of chronic mania, but are features to be avoided in patients of high potentiality. I believe that the Freeman type of operation is the most efficient procedure to employ in cases of long-standing psychosis in whom the maximum effect is

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desired; but that the more limited Crombie operation is less likely to produce harmful effects, and that this less serious measure should be employed in all cases of high potentiality, such as obsessional neurosis. Further experience may indicate that by still greater modification and reduction in the extent and situation of the cut—perhaps by confining the section to the lowest fibres of the lobe—it may be possible to remove obsessional symptoms without the least trace of reduction in the normal activities of the frontal lobe.

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THE EARLY EFFECTS OF PREFRONTAL LEUCOTOMY ON DISTURBED PATIENTS WITH MENTAL ILLNESS OF LONG DURATION.

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THE following findings apply to 50 cases who were operated upon in the last six months of 1942. The very short time which has elapsed since the operations were performed makes it necessary to treat the results with the greatest reserve. It is therefore hoped that this account will be regarded as a progress report.

The operation was carried out with the primary object of relieving the most disturbed patients in the hospital quite independently of their poor prognosis. They formed a large proportion of the most violent, hostile, noisy, excited, destructive or obscene cases in the hospital; the type who distress their relatives, upset the other patients and consume the time and energy which could be put to so much better purpose by the staff. Two-thirds of these patients had received no active treatment by recent methods, and it was not thought to be worth while, as one might formerly have regarded every one as irrecoverable, with the possible exception of five agitated melancholics and one manic-depressive. The oldest of this series was 68, the youngest 31, and 80 per cent. were over 40 years of age.

The average length of known history was just over 8 years; the shortest history was 1½ years, the longest 26. 26 per cent. had been ill for less then 5 years, 44 per cent. between 5 and 10 years, and 30 per cent. over 10 years.

TABLE I.

Age.	Number of patients.	Duration of illness.	Number of patients.
30–40	11	0–5 years	13
40–50	20	5–10 ,,	22
50–60	11	10–15 ,,	10
Over 60	8	15–20 ,,	3
		Over 20 ,,	2

Sixty per cent. were paranoid reaction types, mostly paranoid schizophrenics, 18 per cent. deteriorated cases of schizophrenia who had been in hospital since before the age of 30, and the remaining 22 per cent. manic-depressives, cases of chronic mania, or agitated melancholics who had not reacted to convulsion therapy. In reference to this last point, we would not subject these patients to the present form of operation for prefrontal leucotomy before giving them an adequate opportunity for recovery by a course of convulsions. The success of convulsion therapy is so great that, with the exception of the few failures operated upon, we should have difficulty in finding a chronic melancholic on the male side of the hospital and few such females who were suitable for this treatment.

We have considered some 50 undesirable disorders of conduct to find what effect the operation had upon them. The improvements may be classed into three groups, roughly representing (1) Paranoid, (2) Depressive, and (3) Deterioration symptoms. In the first group are included the symptoms of being noisy, violent, hostile, aggressive, obscene, impulsive, resistive, non-co-operative, restless, obstructive, interfering, irritable and sleepless. In the second, suicidal, agitated,

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hypochondriacal, guilty. In the third, destructive, light-fingered, untidy, dirty, given to hoarding of rubbish or self-decoration.

A point of great interest emerging from these findings is that the symptoms mentioned above and regarded as having undergone significant improvement are largely active in character. Those which failed to benefit were the more passive characteristics such as worry, depression, preoccupation, hallucinations, delusions, ideas of influence or reference, lack of attention, and lack of affect; whilst on the whole the patients showed a distinct diminution in energy.

The following table shows the effect of the operation from an administrative point of view. It indicates that there is an obvious saving of staff and less difficulty in supervision:

TABLE II.

	Before operation.	After operation.
Unemployed	25	14
Sleeping in side rooms	17	7
In night observation	42	21
In "closed" wards	47	37
In "disturbed" wards	40	16
On parole	1	9
Hoarding rubbish	9	1
Destructive	16	1

Two have been discharged; one of whom relapsed and became suicidal again after two months at home, but is now undergoing a spontaneous remission. Two out of these 50 cases died from cerebral haemorrhage, both within two days after the operation.

Three case-histories may be briefly described illustrating some of the best results on the long-standing cases:

(*a*) A female domestic, aged 39, who has been in hospital for 14 years in a second attack of illness, appears from the notes to have been admitted in a state of katatonia. Before operation she was hostile, aggressive, excited, noisy and impulsive in her actions, and also usually incontinent of urine, dirty in habits, resistive and non-co-operative. She was suspicious, solitary, irritable, untidy, moderately destructive and had no contact with reality. She displayed mannerisms, grimaced, was unable to utter a single coherent sentence and was totally unemployed. Following the operation in August, 1942, she showed an immediate improvement, but was rigid and had a Parkinsonism-like expression for two or three weeks following. For two months she was shy, retiring and timid, as if amazed to find herself in contact with the world again. The improvement has been maintained, although she is rather simple, lacking in initiative, has a limited vocabulary, and shows a paucity of ideas; she is happy, on parole, doing beautiful needlework, and has been home on leave for a fortnight.

(*b*) An educated woman, aged 50, who had been 16 years in hospital, twelve of them in this country and four in France. Previous to her operation she was extremely noisy, hostile, aggressive, abusive, obscene, irritable, easily provoked, and impulsively violent in her actions. She had marked ideas of reference, was suspicious, provocative and interfering. She pilfered, hoarded rubbish, decorated herself, was untidy, grandiose, and practically unemployed. As a result of hallucinations she shouted at unseen people in a mixture of French and English and expressed fantastic delusions. She also exhibited swings of mood. Her improvement after the operation in October was immediate, though for some days she was deluded and hallucinated. On the third and fourth days after operation she knitted a child's coat. Before long she went to a villa on parole and has been working since. She has, however, been moderately preoccupied, solitary and worried, and following mild depressive symptoms at the end of January she had a series of electrically induced convulsions which improved her again. She has never been off parole or ceased to work.

(*c*) A male, aged 45, a paranoid schizophrenic of ten years' standing. He was one of the most disturbed patients in the hospital, very noisy, violent, excited, impulsive, aggressive and obscene. He was resistive, interfering, suspicious, and had marked ideas of reference. His delusions and hallucinations were prominent. He believed that cigarette smoke circulated through his body into his testicles, that he had cancer or syphilis, and that he was being tortured and unable to sleep. As a result of his hallucinations he was very worried, had attempted suicide by hanging, and said that he was told that he must drink poison. Two days after the operation, in July, 1942, he was given a cigarette and seemed amazed that the smoke no longer penetrated to his testicles. This symptom has returned but does not disturb him. He has continued to improve, denies hallucinations, but still has hypochondriacal delusions, is a little worried and lacks some restraint. He is now clean and tidy, a first-class worker in the bakehouse, is on parole, mixes well with other patients and has been home for weekends.

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Examining the conduct as a whole, no patient, up to the present time, has been made worse by the operation, though in some the improvement has been very slight. The following is a brief account of one of the two least successful cases. The other is in many ways similar, but is now working very well in the ward, whereas previously she did little and thus the result is appreciably better:

A woman, aged 47, has been ill for ten years with a paranoid psychosis. She was extremely talkative, abusive and deluded, resistive, hostile, and occasionally aggressive and violent. She wrote letters on any scrap of paper she could obtain, in which she complained of everything and everybody and continually threatened legal action to those who were plotting against her, always mentioning the highest courts and officials in her statements. Following operation in July, 1942, she came round rapidly with an immediate flood of speech, a condition noticed in two other similar cases, neither of whom have made an appreciable improvement. She has remained just as deluded, complaining and talkative, but the "sting" of her psychosis has diminished, her hostility has disappeared, and she has not been violent or resistive and is less provocative. She has, however, become more suspicious, her ideas of reference are more obvious; she is rather excitable and is definitely interfering. She only works for herself, but does this rather better than before.

Two other points of interest may be worth noting. First, that three very agitated female melancholics aged 35, 48 and 62 had all failed to react to convulsions, though none had received more than ten for one reason or another. All were previously suicidal. Apart from loss of this symptom and becoming less resistive, none have shown any great improvement. At operation all three were found to have shrunken frontal lobes.

Secondly, a singularly dirty male of 62, a melancholic, remained just as filthy in habits and also became aggressive and hostile following operation. He has become remarkably well with a series of cardiazol convulsions, though he failed to react to electrical convulsion therapy previously. The same applies to a paranoid schizophrenic who is now responding to convulsion therapy which had previously been unsuccessful, but in this case the convulsions have been electrically induced on both occasions, whilst in four other cases a threatened relapse has been avoided by the use of this method.

It is obviously much too early to pass any judgment on the results, though up to now one-third of the patients have shown considerable improvement, one-third have become moderately better, and one-third have shown little change.

The experience so far gained has led us to certain conclusions concerning the technical side of the operation. It will be agreed that the results of the operation are variable, and although we do not wish to minimize the difficulties in the proper selection of cases, it is felt that some of the poorer results may be due to bad operation. We know from operation on the cadaver that the surface marking we have been using—5 cm. above the zygoma and 3 cm. behind the outer border of the orbit—gives a variable cerebral marking. In some of the post-mortem operations we have found that the discrepancies between the actual point of the insertion of the leucotome and the desired point is sometimes quite alarming. This anatomical variation must lead to different fibres being sectioned and hence the possibility of failure to achieve the purpose of the operation; additionally the dangers are in this way increased. In one of our fatal cases, the circle of brain tissue cut was much too far posterior. It is at the moment not quite clear which is the best method of insuring a more accurate insertion of the leucotome. Should a very much wider approach be made so that much more of the cerebral surface can be visualized? This would require a longer anaesthetic, and both this and the instruments required may not always be available in the hospitals where these operations have to be done. The other possibility is to correct the surface markings by comparison between the measurements of the skull in question and those of the average skull.

To date, three of 62 cases have died from cerebral haemorrhage, all within the first four days after operation. We have used an intravenous anaesthetic, evipan or venesetic after premedication with paraldehyde, and it so happened that the fatal cases had required a rather large dose of the barbiturate. This haemorrhage seems to be almost unavoidable in certain cases. The cerebral vessels are notoriously thin-walled, and whatever instrument may be used—the blade of a leucotome, a brain needle, or a blunt knife—it is impossible to avoid occasional damage to a vessel, which when torn will go on bleeding inside the brain. The revolving blade of the leucotome often carries vessels before it and these are withdrawn from the

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brain with the instrument, and on very many occasions we have successfully tied these. In this respect, the leucotome, because it drags out vessels which can be tied, may be safer than any single blade, which might divide vessels in the brain. We have not so far experienced any haemorrhage from the anterior cerebral artery, which appears to have occurred at least twice elsewhere.

Apart from these three fatal cases there has been little evidence, in the way of neurological signs, of injury to the brain. Only one case has had a fit. This occurred three months after the operation, but there has been no recurrence in the subsequent four months.

Kleist has suggested from a study of the after-history of patients suffering from brain injury involving the frontal lobes, that the convex lateral surfaces are associated with psycho-motor and intellectual activities, while the orbital surfaces could be considered the centres of emotional life. This same view has been expressed by a number of other writers. The projection of the dorso-medial nucleus of the thalamus to the prefrontal cortex has been demonstrated in many animals. Walker's work showed that there is as great a degeneration in the medial nucleus of the thalamus after ablation of the orbital cortex as after injury to any portion of the frontal cortex. Our results have suggested, as far as such early findings can suggest anything, that the operation we have hitherto performed leads to improvement in the psycho-motor symptoms rather than in the passive or emotional, whilst the initial improvement sometimes diminishes after a few weeks, suggesting a transitory involvement of other fibres. Does this suggest that we have been dividing the fibres from the convex surface, but not those from the orbital ? Should we set out to divide the orbital fibres alone, or both sets together ? In the light of this evidence we have devised an operation which cuts the fibres immediately above the orbital cortex. So far only two cases have been submitted to this operation, and nothing can yet be said of its effects. It may very well be that we should combine this horizontal plane of section with the former vertical.

From our results, it is still very difficult to describe a type of case likely to improve by operation, but as far as can be judged at this stage it would seem that the impulsively violent, obstructive, resistive and interfering patient is worth choosing as a type in which symptoms will be relieved, and if he has deteriorated, become destructive, untidy, self-decorative and a hoarder of rubbish, apparently so much the better as far as concerns the degree of improvement anticipated. On the other hand, the very talkative, complaining, excitable, suspicious patient, with many ideas of reference and much preoccupation with his own delusions, is not regarded as likely to benefit. In the chronic melancholics, guilt feelings and agitation were relieved more markedly than the depression itself. Suicidal tendencies have disappeared in every case, but in one patient mentioned previously they have recurred five months after operation.

Before concluding it may be interesting to quote the opinions of the two female charge nurses who have in their wards all the failures of operation. The matron sought their frank views on these patients, for, as she said, a friend interested in the nursing results of this operation. The following were their statements:

(1) "I have the bad end of the stick. The eight people with me are the real throw-outs of the leucotomies. For all that, I consider it worth while. All these people, except one, Mrs. G—, are easier to handle. They retain their delusions, but they are different—nicer somehow, not hostile and aggressive; you can reason with them. A. M—, who was one of the nastiest-tongued women I have ever met, still has her bad turns, but is much nicer."

(2) The charge nurse of the other disturbed ward, with seven leucotomy patients now under her case, said: "I don't know—yes I do. On the whole it is worth it. Two of my worst seem much the same; on the other hand, C. T— and N. P—, although still noisy, can sit in safety with other patients, which is more than can be said of them before. N. P— has never smashed since, and at one time everything went."

Finally, if the results are sustained and can be confirmed, it is believed that the operation will have a useful place in modifying the ill-behaviour and unhappiness of many of the chronic, closely supervised patients in mental hospitals.

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Discussion.

Dr. G. W. T. H. FLEMING (Barnwood House, Gloucester) said that three excellent papers had put forward the evidence in favour of prefrontal leucotomy, and he thought somebody should attack it because it was being attacked outside. One of the points which did arise was whether electric shock treatment was to be given, or whether prefrontal leucotomy was to be carried out at once. A number of patients had been operated on without any electric shock treatment beforehand, and there had been amazingly good results, but he thought many people would not agree with that procedure. The patients who showed good results with prefrontal leucotomy were the type which required much electric shock treatment, often with maintenance doses, and when leucotomy was done it was finished in a very short time.

Their results were not perhaps reliable because many of the patients had not had shock treatment; good results had been obtained with the depressed type of patient. The Americans had quoted a number of cases of suicide occurring after electric shock treatment, but as far as he knew, apart from the case which Dr. Dax mentioned, no suggestion of suicide had arisen after prefrontal leucotomy.

The relief which the patient obtained, his "peace of mind," was perfectly amazing. One of the patients who was operated on in the early part of the series under local anaesthesia noticed nothing when the first side was divided, but when the second side was divided he felt as if he had died, he just slumped, then sat up again and felt at once the relief of tension. He was an intelligent man who felt very much better for the operation, although he did not make a good recovery for some four or five months.

All cases should have a considerable amount of psychological treatment afterwards, otherwise they might tend to relapse. Two of his cases were women, one of 70 and the other 56, who seemed to be doing very badly indeed after the operation, but they "pulled themselves together" when told to do so. One woman was very bad indeed after the operation for some four or five months; her husband came to see her and she wanted to go home and he said, "If you can behave like a lady for a week you can go home"; she did, and she went home and had remained perfectly well. Apparently on being told to do it she could. In the case of the woman of 70, her husband came to see her and said she could not go home. She tore his photograph and that of her daughter to pieces and threw them away. When he had gone she made an effort and in about three weeks she went home after she had been lying in bed for four months saying that she could not get up, and that the blinds must be kept down to keep the sunlight out; it did not seem as if the operation had done any good, but when she wanted to do so she could "pull herself together."

The question of age was a difficulty which was largely determined by the appearance of arterio-sclerosis and that was where the neuro-surgeon came into the picture; he had to decide whether he would or would not operate. A patient of 45 had a blood pressure of 240 and the surgeon was a little chary of performing the operation, but she did very well until she was going home, when she had 13 seizures which were probably due partly to the hyper-tension and had nothing to do with the operation. One schizophrenic had had one seizure only in the course of twelve months after operation, so it seemed possible that there might be scar tissue and seizures occurring later. A small percentage of patients had been wet and dirty after the operation, but that had usually worn away very quickly; fully two-thirds had not been wet at all.

Dr. E. H. LARKIN (Goodmayes) said that it was not clear whether the operation acted by partially dementing the patient. Did it have the effect of putting the patient in a continual state of slow tonic contraction diminishing worry and tension, and therefore allowing them to function at a lower level than formerly, but still more pliable? Could Dr. Ström-Olsen give his impression as to this? It would be impossible to test it accurately under the circumstances, but the question arose in patients who were not demented and not in a mental hospital, but were working and asked: "Can I have this operation to relieve tension?" but did not wish to become less efficient members of society.

Dr. WILLIAM SARGANT (Maudsley) said that at the hospital where he was working it had not been possible to do prefrontal leucotomy up till just recently, but several cases thought suitable for the operation had been seen or transferred to St. George's Hospital O.P.D., subsequently operated on at an E.M.S. Surgical Unit, and after a fortnight sent back to their homes. These were cases in whom all other treatment had failed to produce recovery, spontaneous recovery was considered unlikely, but they were not as yet severely deteriorated by long periods of hospitalization. Up to now these patients had not shown any marked degree of added mental deterioration as a result of the operation. I.Q's rose in two of the cases re-tested. There was no time to discuss the results in detail, but they were somewhat similar to those cases seen by him in America, just before the war, done by Freeman and Watts. Whatever the psychiatric condition present, one symptom that seemed to benefit from this operation was obsessional rumination. This was the impression that he had obtained from seeing some of Freeman and

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Watts's cases and studying his own material, and in the cases done at St. George's Hospital obsessional preoccupations were one of the prominent features of the total picture and that was why they were chosen. If cases were to be done relatively early when all other methods of cure such as insulin, electrical shock treatment and psychotherapy had failed, it was important that the operation should be done conservatively. He had seen two other cases in which a more extensive prefrontal leucotomy was performed, and there had seemed definite added deterioration in these cases as a result of the more extensive procedure. He felt that the operation should be confined to the minimum, and before it was attempted in each case it should be decided just what one was setting out to achieve in the way of altering the symptoms present. Endogenous depression or schizophrenia as diseases *per se* were not likely to be cured by prefrontal leucotomy, but certain symptomatology such as obsessional rumination might be extracted from the total psychiatric picture to the benefit of the patient. This may mean the difference between the patient remaining completely hospitalized or being able to live in varying degrees of adjustment in the community. The fundamental quality of the previous personality will also determine to a great extent the result achieved. The use of clinical judgment and discrimination in choosing each individual case is therefore absolutely essential. The relief of severe mental suffering by the patient in the successful cases is also a feature of this operation which cannot be disregarded, especially the long-standing involutional type of melancholia with obsessional rumination.

Dr. E. STENGEL (Royal Edinburgh Hospital for Nervous and Mental Diseases) said it was doubtful whether the attempt at localizing the super-ego into the frontal lobes would benefit the knowledge of either the super-ego or the frontal lobes. How hazardous such statements were could be seen from the fact that frontal leucotomy was supposed to be of value in cases of melancholia and obsessional illness where the super-ego was notoriously overactive. In trying to relate alterations of behaviour and personality to cerebral lesions it seemed advisable to consider basic functions first, and only secondly to investigate how changes of those functions affected complex structures such as the super-ego. The effect of the operation on various conditions suggested that among other activities those of the aggressive instincts were reduced, whether they be directed against the outer world, as in those patients who had been aggressive and unmanageable, or against the self, as in the cases of melancholia and obsessional illness.

It was noteworthy that features similar to the effects of frontal leucotomy were fairly characteristic of the behaviour of patients who had extensive lesions of the white matter of the cerebral hemispheres including the corpus callosum. He had recently expressed the opinion that the difference in the behaviour of patients with Alzheimer's disease, who usually were restless and very often distressed, and of patients with Pick's disease, who as a rule showed a lack of initiative, may be due to the fact that in the latter disease the white matter was grossly affected. This was of interest in view of the results of leucotomy, which, by damaging the white matter, removed the symptoms of hyperactivity.

Lastly, he wanted to ask Dr. Ström-Olsen, who reported cases of epilepsy in which frontal leucotomy had been carried out, whether the operation had any effect on the frequency of the epileptic attacks.

Dr. ALEXANDER (Edinburgh) asked if he might be permitted to speak as a guest. His experience of prefrontal leucotomy was very recent and limited to a series of only eight cases. In the first group of cases with which they were asked to deal there was in several in the small area of cortex exposed a very conspicuous cortical atrophy, and he understood that that was rather surprising in that schizophrenic cases were the subject of these operations. It occurred to him that possibly prolonged treatment with shock therapy—both cardiazol and electrical—might be responsible for that cortical atrophy, and he would suggest that no opportunity should be missed of studying any brain which might fall into the hands of the pathologist after electrical shock therapy, in order to study the minute histological changes in the cortex which might be produced by that treatment.

In either the *British Medical Journal* or the *Lancet* there appeared a paper giving an account of experimental observations on the effect of shock therapy in animals and intra-cerebral haemorrhages were found.

He would suggest that in view of the very heavy commitments of the medical profession, and particularly of surgeons, it would be wise at the earliest possible moment to crystallize their ideas with regard to the result of the operation, especially from the economic point of view.

Prof. JAMES MACDONALD (retired) suggested that it might be as well to have a discussion on the effect of the operation. He was inclined to be antagonistic to the whole procedure, based largely on the realization that the frontal lobes represented the highest form of evolution, and if there was one thing which distinguished the human being from the anthropoid ape it was in the existence of the frontal lobes. He wished to know more about this suggestion of interfering with them; at one time he went further and called it vivisection; it was human vivisection because there was no definite basis for it; it seemed to be purely experimental. He was not against experiments which were rational, but he could not see the rationality of this at all. Having listened to the results claimed by competent observers he must be a little careful; he was not prepared to say he did not believe in them, because the speakers were competent men. A point which occurred to him was the generality of types treated; the operation seemed to be applicable to a great number of types of mental disorder. Was it so applicable?

The prefrontal lobes were the highest organ of intellectual development, and any form of

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mental disorder, even neuroses, might involve the frontal lobes. There was no such thing as definite localization in the frontal lobes. They did not know what they were doing, and he himself was adopting a neutral position.

Prof. MacDonald then referred to the legal aspect of the operation. He remembered a case in which he wished to operate on a patient and a judge said, "You cannot do that; you are subject to damages if the patient recovers." He did not think a patient would recover in the full sense of the word after prefrontal leucotomy, but he thought the legal attitude would be that an operation of this character could not be justified. If it was an operation involving life or death it would be sanctioned, but in this case he thought it was open to grave legal objections as well as fundamental objections.

He was anxious to hear what was done, how much area was disturbed; there could only be a reduction in the man's capacity. Were the cases more controllable because they were more animal-like?

Dr. L. C. Cook (Bexley) said that the main object of the session had been to hear the experiences of those who had worked on leucotomy in this country with a view to learning what type of patient and what symptoms were relieved by this treatment. He thought it had been generally agreed that tension and agitation, over-activity and excitement, destructiveness and violence were the symptoms most influenced. The actual diagnosis, as Dr. Rees had pointed out, did not appear to matter very much, and definitely the duration of the illness was not of such prognostic importance as with most so-called shock therapies. Prof. MacDonald has stressed the need for caution, and he (the speaker) thought that so far workers had been very cautious in choosing for the most part patients with long-standing symptoms. These cases constituted very unfavourable material, and such good results could not be expected as might be obtained with more recent cases. They were wise, however, to confine themselves to patients who had not responded to other forms of treatment or who had been in a state of mental disorder for some time.

Twenty-one patients had been leucotomized at Bexley Hospital by Mr. McKissock and had shown, on the whole, promising results. Of 13 schizophrenics varying from two to twelve years in duration, who had been chosen mainly because of their extremely violent and troublesome behaviour and who had responded only transiently to convulsion therapy, three had been discharged in states of good remission, one showed great improvement, four improved slightly, four did not improve, and one died. The patient who showed great improvement was in some ways the most satisfactory of all, and was a typical example of the use of leucotomy in chronic schizophrenia. This patient was by far the most violent, animal-like catatonic whom even the most senior nurses in the hospital could remember, and after twelve years of "unapproachableness" she had for over a year been up and about, playing the piano, knitting and doing embroidery. She was still as mentally ill as ever she was, but the nursing relief was very great and she was much happier. Some of the cases were definitely disappointing; two very hostile paranoid schizophrenics, both of about two and a half years' duration, showed no improvement and remained as hostile and apparently as deluded as ever, and one typical catatonic had been rather more violent since the operation. Two cases of chronic psychopathic personality, who had before leucotomy spent many years trying to smash up the hospital, were now on parole and had given little trouble for many months.

Four cases of melancholia, three of them involutional, had undergone the operation; of these, three had attained good remissions, while one was only slightly improved; this case had not responded to a previous course of convulsions.

In this connection he heartily endorsed the opinion of Dr. Rees and Dr. Dax, who pointed out that all cases of melancholia should be given convulsion treatment before leucotomy was attempted. One other case which he might mention was a chronic manic of twelve years' standing who for the last two or three years had been the filthiest, most degraded patient in the hospital—in fact the horror of any ward to which she was sent. She did not improve for some weeks after the operation, but had now become very much better in her habits, although her mind remained grossly disordered. He agreed with Dr. Ström-Olsen that one must give time for the results of leucotomy to become evident. One should give at least six months and, in his opinion, from these few cases of which he had had experience, when improvement did take place it tended to be more lasting than in many other forms of therapy.

He appreciated Dr. Rees' interesting essay in co-ordinating the psychological and physiological approaches to the subject. Even if, as Dr. Rees himself suggested, it might turn out to have little basis in fact, it did give some working basis for selection of cases for operation.

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THE RANGE AND TECHNIQUE OF PREFRONTAL LEUCOTOMY.

By F. L. Golla, M.D., F.R.C.P.,
Director, The Burden Neurological Institute, Bristol.

When Dr. Cook, who has the thankless task of organizing the papers and discussion of this meeting, told me I had let him down because I had not secured one of the most distinguished surgeons in the country, Mr. Jefferson, he put it to me that the least I could do was to fill in the gap. I was puzzled as to what to say until Prof. MacDonald gave me a clue, and instead of talking on physiology and anatomy, which, after all, you probably know better than I do, I propose to give you a few general considerations which seem to make for the defence of an operation such as this against Prof. MacDonald's criticism.

The whole of Prof. MacDonald's cricitism depends upon a static view of the central nervous system; it is a view in which I was brought up, and which was popular in physiology and is taught in the medical schools at present. It is an easy view. There are centres which govern movement, centres which govern sensation, centres which govern inhibition, in other words one goes back to the telephone-system idea of the central nervous system, by which messages can be sent from one part of the body to the other, and messages arriving from one part can be co-ordinated with messages from another. Until such time as we realize the almost infinite lability of the central nervous system we shall find ourselves at fault. So long as we continue to make classifications of functions, to localize functions, to try to think what will happen here or there in consequence of a lesion, we shall always be liable to find ourselves outwitted by the recuperative powers of the damaged nervous system. I think possibly I could illustrate what I mean by referring to some quite old work, which is very little known because it is inconvenient to incorporate it in textbooks or to lecture about it. I refer to the work of Sherrington and Graham Brown on the motor cortex of the chimpanzee. They trained the chimpanzee to open a cupboard door, turning the handle with one hand and the key with the other, to get the food out. Having trained him they destroyed the motor cortex on one side and he became hemiplegic. In course of time he not only recovered from the hemiplegia but was able to perform his usual tricks. They then exposed the whole of the cortex on the mutilated side and stimulated it electrically, and found no other area had taken over the function of the motor cortex. Having failed to find such an area on the homonymous hemisphere, they destroyed the motor cortex on the other side. Again the chimpanzee became hemiplegic, and again he recovered. He was able to perform all his tricks without difficulty. On neither hemisphere could electrical stimulation reveal any motor focus.

When I was assisting Sir Victor Horsley at Queen Square, operations were occasionally performed on cases of Jacksonian idiopathic epilepsy. One of the cases I remember was that of a man who had Jacksonian fits beginning in the thumb; the corresponding area in the cortex was excised and subsequently he had complete flaccid paralysis of the hand, from which he gradually recovered. A year or so later his only comment was that he did not think he played tennis quite so well as before the operation.

What is the point of all this? It seems as though the central nervous system can re-orientate itself. If it cannot work in one way it will do so in another. We have not done irreparable damage by cutting the 'phone system. If there is dysfunction in one part another will take on its functions. In our own experience we know that if we cannot remember something in one way we try to remember it by some other method; if we cannot perform an action by one method, we cast about until we find another.

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After a destructive lesion, the central nervous system is not, of course, exactly the same as before, but it is going too far to say *a priori* that any particular lesion will make it impossible for the central nervous system to perform any particular action; it may do it more circuitously, probably not so skilfully, but I think one can say this, that it is up to the opponent of Moniz's operation to show that one has inflicted a lesion of such a nature that the nervous system is unable by any other mechanisms to perform the majority or possibly all of the mental operations which it executed before. I do not say that they are performed so well, but they may be performed, sometimes even a good deal better. If one alters the particular form of imagery used by certain people, their mental operations may be very much improved.

At the Burden Institute Dr. E. L. Hutton and I are engaged in some research on the forms of imagery which are used in mental operations, and one notices that certain types of imagery may constitute a grave disability for certain modes of mental operations. I am one of those who hear the " still small voice " all the time, which may often be a grave disability, particularly if I wish to do mental arithmetic. If I had some form of cerebral lesion affecting my auditory kinaesthetic mechanism and compelling me to adopt visual imagery, I should not be surprised if ultimately my performance at mental arithmetic did not considerably improve.

What are we constantly doing in psycho-therapy? You may tell the patient who is oversexed to sublimate, and concentrate on other forms of thought. You are doing in fact psychologically what Moniz and his followers are trying to do by surgical methods. One is transforming one particular method of thought into another which is more useful, or which at any rate leads to less disturbance of mental activity, and that is what one is trying to do all the time in psycho-therapy.

This operation was first performed in this country at the Burden Institute, after encouraging reports from witnesses who had seen the results in U.S.A. and elsewhere had been considered, and it was felt that they were too striking to be set aside. Other people can tell you whether the results have justified the operation. All I want to say is that if one thinks that, *a priori*, one must be depriving a person of the potentiality of exercising any particular mental function by an operation of this description, the proof rests with the opponents of the operation. There are indeed one or two cases in which it is improbable that anything of the sort has happened, if one relies on the evidence of family, employers and friends.

I admit that immediately after the operation there seems to be an upset of the nervous system, the nervous shock, Von Monakow's diaschisis, then the symptoms of deprivation follow, but three or even six months afterwards recovery may be virtually completed. If irreparable damage has not occurred before the treatment, the patient may have learnt to use other mechanisms for his mental operations, and very often learnt to use them just as well as he did before.

With regard to the physiological side, one must confess that animal experiments do not contribute much to one's knowledge of this problem.

One has heard much talk of a lack of prevision in these patients. I do not think there is a lack of prevision with reference to non-personal changes in the environment; I think if they were chess players they would be able to see moves ahead as before. The lack of prevision is connected with the forethought which is concerned with the appreciation of the situation of the self in relation to the environment. It is there that they become careless, because they no longer seem to appreciate their social obligations, or pay much attention to their relations with others, but after months, possibly a year, there is a gradual re-education of function, always provided that one has started with a nervous system which has not hopelessly broken down.

A similar process probably takes place in the malaria treatment of G.P.I. patients. For many years I saw every G.P.I. treated by malaria in L.C.C. hospitals, and found that for months—sometimes a year—after they had been discharged from Horton as having been effectually dealt with by fever, they still continued to improve. I do not think anyone with a knowledge of G.P.I. would believe that there was a gradual resolution of the inflammatory process. The patient was exploring fresh, if more roundabout, neural mechanisms, and he was adopting more circuitous, but sometimes equally efficient, ways of conducting his mental processes.

Lastly a word about the operation itself. I have the feeling that we are going

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to be able ultimately to dispense with Mr. Willway's services. I think, instead of this brutal and bloody operation, we shall be able to obtain our results by the use of physical methods. There are many difficulties involved in this policy. The conduction of an electric current inside a sphere has yet to be studied in relation to the head.

One has, however, certain results even with the electro-convulsive therapy which show some resemblance to the operation of leucotomy. I regard the electro-convulsive therapy as a temporary leucotomy, but I will not go so far as to say that the people who do not improve with convulsive therapy will not improve with leucotomy. The trouble is that the E.C.T. effect is only temporary. When checking our results with the electro-encephalogram one finds that one gets signs of the same type of cortical changes that one does immediately after an operation for leucotomy. Of course it is not quite the same thing. In one case there is a severance of nerve tracts, and in the other we are injuring and destroying the nerve cells. Obviously we never sever all the tracts, and probably we are throwing out of gear for varying lengths of time the cells not only in the prefrontal area but in a great part of the frontal lobe. Electrical treatment involves a much bigger area than is imagined. It is not possible at present to localize it to the prefrontal area, and following it one gets a greater degree of excitement and a greater degree of amnesia than with leucotomy.

One last point: I saw Mr. Willway operate in the first case under local anaesthesia; the man was talking the whole time, and when the severance of the tracts took place the talking continued without the least hiatus or any indication that anything had happened. This is an interesting proof that a very complicated mental operation can be continued without the immediate agency of the prefrontal area.

The time is coming when we must abandon in this connection—as in neurology as a whole—the mechanistic faith in which we were brought up. We have to see things as a whole, to adopt a comprehensive view of the nervous system; we have to realize that it is something more complicated, more wonderful than the physiologists have ever thought of, and if Prof. MacDonald will agree with this I think he will see some indications for this operation.

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THE TECHNIQUE OF PREFRONTAL LEUCOTOMY.

By F. WILFRED WILLWAY, M.D., M.S., B.Sc., F.R.C.S.,

Temp. Hon. Asst. Surgeon, Bristol Royal Infirmary; Surgeon, Burden Neurological Institute, Bristol.

I HAVE been briefed to address you for half an hour on what must be a rather uninteresting subject to an audience composed mainly of physicians, namely the technique of the operation the results of which we have learnt this morning. May I congratulate this audience on showing such interest in the technicalities of the surgeon's art?

Any surgeon confronted with this operation may well be forgiven for asking, "What exactly am I asked to cut?" So far as I know no precise answer exists to this question. The critical plane of section must obviously be of prime importance in a destructive and irreversible procedure. Freeman and Watts indicate that if too much is divided great harm may be done, indolence, profound inertia or excessive euphoria resulting. If too little be divided then insufficient personality change occurs; this at least confirms that the benefits in successful cases are not due to psychotherapeutics, but to an anatomical change. The question that still requires an answer is best put as "How *little*—not how much—do we need to divide in any given patient to produce improvement?" I have done this operation 73* times, and with nine exceptions have used the same technique throughout. I do not therefore claim to have experimented much in regard to different planes of section. My feeling at the moment is that a fairly extensive mutilation is necessary. Almost certainly it should be bilateral though this is not proved. In one case in my series a unilateral operation on the right side was performed, the man made a quick resocialization, returned to work as a docker and was regarded by his employer, mates and family doctor as "normal." After three months symptoms returned, particularly delusions and hallucinations. I operated on the other side. Again prompt recovery followed, which up to date is maintained.

Freeman and Watts arbitrarily state that the plane of the coronal suture is the plane for the white fibre section. Questions such as "Should the section be made by open or closed methods? Should the fibres be divided electrically by the knife or by alcohol?" are points of individual surgical preference and are of secondary importance. Some surgeons have devised special instruments. I personally use a paper knife, but this, too, is of secondary consequence. It is what you cut, not how you cut it, that chiefly affects the patient. I have not done as much cadaver work as I should like, but here are some pictures of the operation done by the Watts Freeman technique on cadavers (Figs. 1, 2 and 3).

It can be seen that the damage to the exterior of the brain is slight. It is even less than Fig. 1 shows as the cut was forced open to show in a photograph and the brain has split a little; also I am now using a narrower knife than I did then. The cut in the white matter is truly formidable. I think the cut in Fig. 2 is too far posterior. It must be remembered that in the cadaver the C.S.F. does not flow as easily as in the live subject, and hence the control of entering the anterior horn of the ventricle used in the living is lost in the cadaver.

The Freeman and Watts Method as Understood and Used by the Author.

Fig. 4 shows the landmarks used to mark out the coronal suture and the site for the trephine hole. I regard these as approximate and not to be taken too meticulously. I now generally trephine 6 cm. above the zygoma and not 5 cm. as shown in Fig. 4. I trephine in preference to making a burr hole as the disc can be replaced. The skin incision can usually be made in the hair line. When the dura mater is reached I use a caliper to measure the width between the two dural

* At time of going to press 82 times.

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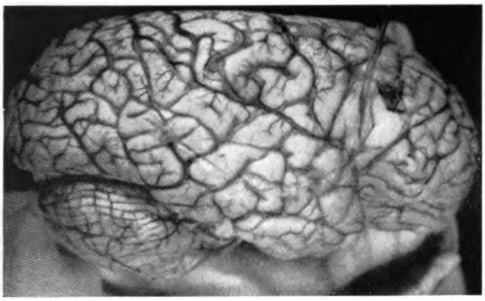

FIG. 1.—External surface of brain which was leucotomized after death.

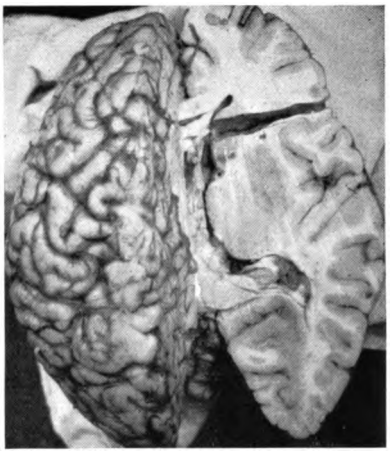

FIG. 2.—Horizontal section of brain in Fig. 1.

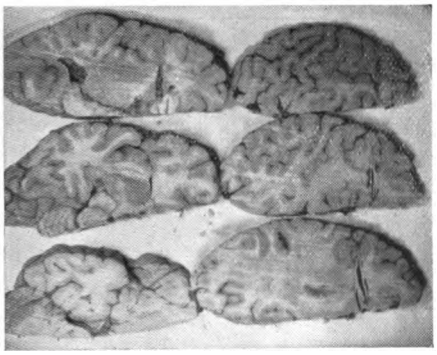

FIG. 3.—Slices of same brain as Figs. 1 and 2. Note the double nature of the cut.

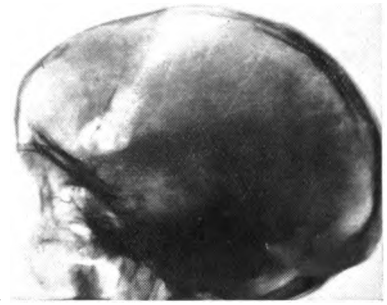

FIG. 5.—Thorotrast in incision made by Freeman and Watts' method.

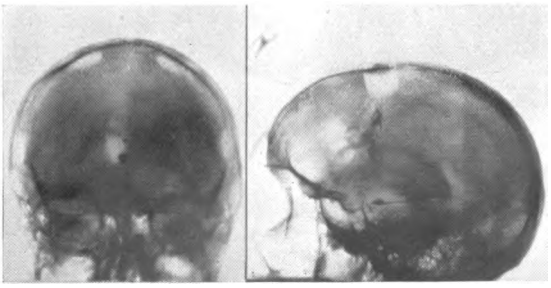

FIG. 6.—Thorotrast in incision after leucotomy has been performed by Freeman and Watts' technique and subsequently Lyerly's method. Note the escape of fluid into the ventricle on the right side.

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openings across the head. The width averages about 10–11 cm. I take half this to be the distance to the midline and set my knife for a little less than this half distance. The cuts are made parallel to the coronal suture line, the wound washed with Ringer's solution and the incision closed in layers. The two X-rays show the sort of result from this admittedly most imprecise procedure. Fig. 5 shows a cut a little anterior to the coronal plane. Of course the thorotrast by no means necessarily outlines the whole cut. Fig. 6 is unusual. The patient was of special interest. He was highly educated, a D.Sc. of London University, but developed persecutory ideas and is labelled as a paranoid schizophrenic. I performed leucotomy by the Freeman-Watts technique on October 14, 1941, but the result was disappointing. After much pressure I consented to reoperate, and on February 19, 1943, used Lyerly's open method. The film shows the formidable section obtained and the ventricle opened on the right side.

Anaesthetic.—I do not regard this as of great consequence. Most of our patients have been resistive and unco-operative and hence we chiefly use a general anaesthetic; at the present time nitrous oxide, oxygen and ether. I have done the operation under local on four occasions. If the patient is co-operative (an unlikely event) it is an interesting method, as the patient's reactions are observable.

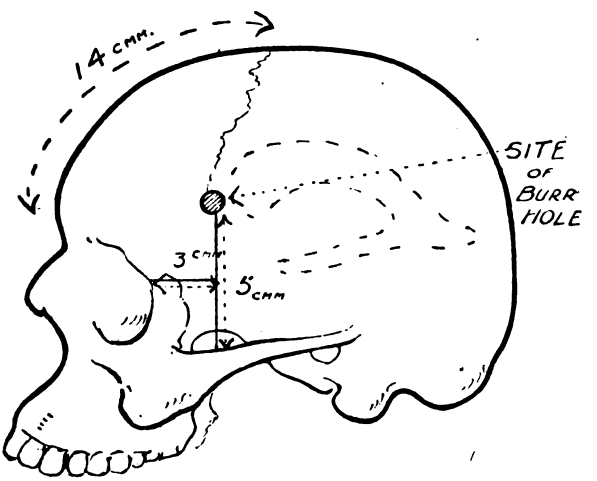

FIG. 4.—Surface markings of the coronal suture in the Freeman and Watts technique. Drawing taken from Freeman and Watts; with acknowledgments.

Mortality.—I have had two deaths in the series of 73 cases; they were Case 4 and Case 9. This caused me much concern, and after Case 9 I introduced the modification of measurement across the head. Since then no deaths have occurred and no case has caused post-operative concern. Two cases in my series were over 70 years of age; one a brilliant success, the other was done only three weeks ago. Physically speaking we can class this as almost a minor operation; its technique is easily learnt—this I dread as one of its greatest dangers, because it can easily be performed by amateur surgeons without careful psychiatric investigations, and quackery could readily follow.

A concluding paragraph on the selection of method.—I do not advocate the Moniz technique of alcohol instillation or electrically cut cores. I think it is liable to miss fibres which should be cut. Doubtless it will often prove successful, but is liable also to give more disappointments. Lyerly's open method is fundamentally sound, very attractive to the neurosurgeon and to all who hate blind procedure—it has the demerit of being a more formidable operation. The method described, the Freeman-Watts technique, is simple, relatively safe, but blind. I am pleased with the results obtained using it; I propose to continue its use, but with an open mind to the advantageous claims of other methods.

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THE TECHNIQUE OF PRE-FRONTAL LEUCOTOMY.

By Wyllie McKissock, M.S., F.R.C.S.,
Neurological Surgeon, E.M.S.

May I apologize in advance for the many deficiencies of the paper I am about to read. I have not had the time that I would have wished to spend upon its preparation, nor the opportunity to make myself more than superficially conversant with the increasing literature, and I trust that you will excuse such imperfections as will appear.

Had it not been for the insistence of Dr. Cook I should have refrained from producing a paper at all, feeling as I do that my experience is as yet too limited, and that insufficient time has elapsed fully to estimate the end-results of the work already done.

It is my intention to deal mainly with the surgical side of the problem, as that is my proper sphere, and because there is much that may yet be said upon this rather important aspect of the matter.

Since Moniz first carried out the operation of pre-frontal leucotomy in November, 1935, many alterations in technique have been made both by the inventor of the procedure himself and by other surgeons who have followed him in this field.

You will, no doubt, be familiar with the major changes which have taken place. The original method was that of the injection into the white matter of the pre-frontal region of small quantities of alcohol, then came the introduction of the first leucotome, with its wire loop cutting complete spheres of brain of one centimetre diameter, and since that time both the instrument used for the section and the chosen site of operation have undergone further changes.

The avowed object of the operation is to sever the association tracts between the frontal poles of the cerebral hemispheres and the remaining portions of the central nervous system, and it would seem good practice, therefore, to choose a weapon which would not only achieve this purpose but, at the same time, inflict the minimum of damage upon the surrounding brain substance and its contained blood vessels.

If one regards dispassionately the set of instruments used by almost any surgeon in the practice of his art it is indeed difficult to abstain from criticism. That they are clumsy and but ill-adapted to their work is obvious to the most uneducated eye. They compare, relatively speaking, most unfavourably with the items of the tool kit supplied with the average modern automobile. When contrasted with the delicate, but strong and beautifully designed tools of the dental surgeon they appear even more gross and unsuited for their work than at first sight. And why should this be? It is due only to us surgeons ourselves; we are as a class most unmechanically minded men, and yet we persist in inventing instruments for particular purposes, each one of which we fondly imagine is better suited to achieve its end than anything that has gone before. No finer example of this tendency could be found than in the astonishing creations which have been produced in connection with pre-frontal leucotomy. The last such instrument I was shown, and ardently encouraged to use, more nearly resembled a mechanical egg-whisk than an implement of modern surgery—yet I was assured that Mr. So-and-So found it most satisfactory! At long last we are beginning to follow the sensible path, that of taking the advice of the trained instrument maker, who has had the opportunity of watching the specialist surgeon at work. He, the instrument maker, can and will produce the simplest and most effective structure to deal with a given problem. More than this, he will provide an instrument capable of performing adequately a variety of duties, thus reducing substantially the armamentarium of the surgeon and the confusion of the theatre sister.

Prompted by a recent letter from a psychiatric colleague who asked, "Have you yet published a detailed description of what you do? Could you let me have a

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copy if you have ?," I propose to describe as carefully as possible what has been my practice.

First, let me confess to you that I have now committed the operation of bilateral pre-frontal leucotomy upon no less than fifty occasions. The method was that of the blind approach, and I would emphasize that this has not been from choice, but because of the conservative attitude of those who are convinced that a surgeon will do more harm within the skull the larger the hole he is allowed to make —an ostrich-like attitude in view of the consistency of the brain substance, the inconstant contours of the cerebral convolutions, and the frequently anomalous arrangement of the blood vessels and fluid-filled spaces of the hemispheres.

Owing to the extremely unpleasant and dangerous habits of many of the unfortunates who have been submitted to me for operation, and to the lack of proper facilities for dealing with the habits of such patients in my own neurosurgical unit, I have been compelled to carry out the procedure of pre-frontal leucotomy under conditions which have been less satisfactory than a neurosurgeon would desire. That this has been so is due in no way to the physicians concerned, nor can I feel that I am wholly responsible. It may well be said, however, that a lower mortality-rate and a lesser number of complications would follow were the patients treated in surroundings which approximated more closely to those of a modern neurosurgical unit.

Whilst many American surgeons have advocated local anaesthesia as being most suited to the operation, I must admit to having used a general anaesthetic in all but two of my series, and, as the operation takes but 15 to 30 minutes to execute, and the anaesthetist has invariably been well versed in endotracheal work, I have seen no complications which I could certainly lay at this door. Not for a moment would I deny such advantages of local anaesthesia as the lack of intracranial congestion so often experienced with gas, oxygen and ether, and the opportunities afforded for observing the phenomena which occur at the time of brain section; in suitable cases local anaesthesia is unquestionably the method of choice. Many of my patients, however, by reason of the very frailties which promoted surgical treatment, have hardly lent themselves to such a course, whilst the mere history of others has persuaded me not to lend myself to it. A general anaesthetic is, I feel, a more restful and less anxious business for all concerned.

I have in general taken a point 3 cm. behind the lateral margin of the orbit and 5–6 cm. above the zygoma as the centre of my 2–3 cm. skin incision. The incision is made down to bone, and a self-retaining retractor inserted firmly to give a wide exposure and a bloodless field. A 1 cm. burr-hole is then cut in the line of the coronal suture and a cruciform incision made in the dura.

The instrument used for the section of the white matter is the least damaging of all—an ordinary brain needle, with a side eyelet just short of the blunt point, and a close-fitting stylet. This is introduced in such a direction as to pass close in front of the anterior horn of the ventricle to a depth sufficient to be just clear of the grey matter of the inner aspect of the frontal lobe. The stylet is withdrawn and the needle made to pivot about the point of entrance through the dura so that the blunt inner extremity travels upwards towards the superior surface of the frontal lobe. As the point is made to travel upwards the needle is pushed more deeply into the brain so that the line of the section runs parallel with the falx and does not, as it otherwise would, become steadily more distant from it. When the needle has reached sufficiently close to the upper surface of the hemisphere it is withdrawn and re-introduced along the original line in order to deal with those fibres running from the lower part of the frontal pole; on this occasion the point of the needle is made to travel downwards, again parallel with the falx, and is then brought laterally across the anterior fossa roughly in the same vertical plane as the lesser wing of the sphenoid, until it reaches a point just short of the lateral aspect of the skull. During this part of the section the needle is progressively withdrawn for fear of damaging the grey matter of the orbital surface of the frontal pole.

A wet patty is then left in the opening in the bone whilst the performance is repeated on the opposite frontal lobe.

The first incision made is then closed in three layers with fine, unabsorbable, black silk sutures, after which the second is similarly treated and a head-dress finally applied.

You will observe that I have refrained from giving any measurements regarding

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the depth to which the brain needle should be inserted. This has been done deliberately to emphasize that there can be no routine or hard and fast rules in such a matter. The width of the human skull in the region under consideration is very variable, and whilst the introduction of the needle to only 5 cm. from the dural opening in one patient might sever the anterior cerebral artery, an insertion to 7 cm. might be inadequate in another.

There are other difficulties of a similar nature: the bone itself may be so thick as to prevent adequate rotation of the needle, and here it is necessary to remove more bone above and below the initial burr-hole to make a wider range of movement possible.

It should be obvious, I feel, that this operation is one not to be undertaken lightly, and calls for fine accurate technique as well as regular experience of intracranial surgery.

The immediate post-operative complications of importance are few in number, so far as my own experience goes, and are common to most other intracranial operations, the most serious of all being that of haemorrhage, either immediate or delayed.

This sequel was the cause of the single death in my series of cases, precipitating a fatal pneumonia. The difficulties of treating such cases at a distance are only too obvious, and I believe that even this one case might have been saved had the patient been operated upon in time.

The progressively falling pulse and respiration rates associated with a rising blood pressure should give ample warning of impending death, and permit of open operation being resorted to. Difficulty would no doubt be encountered in finding the bleeding point, but its eventual control should be comparatively simple.

Incontinence of urine occurs with comparative frequency, and occasionally there is incontinence of faeces also, but in no case to my knowledge have they remained permanent. In the vast majority incontinence of urine alone takes place, lasts for a few days and then is seen no more.

Restlessness and irritability, even extending to extreme violence, have been met with, usually in such patients as have exhibited similar behaviour before operation, but on only two or possibly three occasions have the patients proved more violent and uncontrollable after operation than before.

Amnesia, confusion, somnolence and lack of initiative have been common sequelae and have generally been transient, although a few patients have finally subsided into a harmless vegetable existence. Quite a number of patients have gained considerably in weight.

I have touched but lightly upon these sequelae which are, after all, common knowledge, and have been commented upon in detail by other writers, as well as being discussed in detail by Freeman and Watts in their volume, *Psychosurgery*.

Reference to this work, *Psychosurgery*, reveals a number of interesting facts. Out of the author's total of 80 patients it is stated that permanent incontinence of urine was noted in four patients, rectal incontinence in three patients, monoparesis in one, aphasia in two, hemiplegia in one and convulsions in three patients, and, in addition, three patients died.

In most neurosurgical units the operative mortality in this series of Freeman and Watts would have been assessed as four deaths in 80 cases, for one of their patients, in whom the left anterior cerebral artery had been damaged with resultant right hemiplegia, died four months after operation from pneumonia. This should certainly be attributed to the operative interference with its sequelae of hemiplegia, prolonged stay in bed and pneumonia.

Convulsions are said to have occurred in three cases out of 80, and these cases are summarily dismissed by the authors of this work in one short paragraph as if the matter were of only trifling import.

We have therefore in this series of Freeman and Watts an appreciable death-rate directly due to surgical treatment, and a much more appreciable list of serious disabilities following the leucotomy.

That this is a somewhat unpleasant collection of results cannot be denied. Incontinence of urine and faeces, paralysis of one limb or of one half of the body and aphasia—not to mention convulsions—are very real factors to be weighed in the balance when assessing the value of the operation or the need for its performance.

My own experience is, as I have mentioned above, limited to only 50 cases, but I have always been conscious of the dangers which abound in work of this nature.

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I have had one death occurring on the eighth post-operative day caused by bilateral frontal haemorrhage. There have been no serious sequelae of the neurological order reported by Freeman and Watts, but there have been four patients who have had seizures.

In no one of these four patients had convulsions been known to occur before the onset of their mental illness, but two of the four had been treated by convulsion therapy before leucotomy was undertaken.

One patient, four months after leucotomy, suffered a series of 13 major convulsions in the space of a few hours; she recovered well with the usual modes of treatment and now, some months later, has had no further fits. This young woman had been known previously to have a very high blood pressure and albuminuria, and her attacks might therefore be considered to be other than purely cerebral in origin. I prefer, however, to regard them as a sequel of operation.

A second patient, a woman aged 57, had had no convulsion treatment before leucotomy because of a severe kyphosis, but went into *status epilepticus* five months after leucotomy. She remained in *status* for six hours and recovered spontaneously. Three months later she again passed into *status epilepticus*, from which she recovered in about two hours after heavy dosage with sodium luminal. It is now three weeks since the last attack and the patient is being given luminal regularly.

The third and fourth patients, men aged 27 and 48, had each had convulsion therapy before leucotomy. Each patient had seizures passing on to *status epilepticus*, in one case occurring four months after leucotomy and in the other five months. Both patients recovered quite rapidly with the appropriate remedies.

In no one of the four cases have residual physical signs been found at neurological examination.

Ventriculography has been carried out in three of the four cases, using the right pre-frontal burr-hole, and in all three there has been good filling of the ventricular system. No abnormality whatsoever has been observed in the region of the anterior horns to suggest the presence of a space-occupying lesion, such as blood clot, nor has there been even a suggestion of early traction diverticulum.

There is, therefore, no gross organic lesion present in any one of these cases. The fact remains that there are now in the world four more epileptics as a direct result of my surgical attack upon these 50 individuals.

I have, therefore, been responsible for none of the unfortunate neurological complications reported by Freeman and Watts, but I have had an incidence of traumatic epilepsy of 8 per cent. if we can rely upon such a small series of cases as being representative.

Of the other side of the picture, and before such an audience, it is not within my province to speak. I make no claim to psychiatric knowledge, and would prefer to leave the discussion of this aspect of the problem to those who are qualified by training and experience to do so. I need hardly say, however, that had I not been convinced of the benefits accruing from operation in at least a moderate percentage of cases, I should not have pursued the subject as far as I have.

It has been my duty to put before you to-day the purely surgical side of this problem and I have dwelt for that reason upon the associated dangers and complications. I have done so because, in the first flush of a new enthusiasm, surgeons are all too ready to overlook the occasionally serious, if not fatal, results of their manoeuvres, and to look with a complaisant eye upon the more successful.

It has been unfortunate, in my opinion, that this operation should have attracted so wide an attention in this country, and that those in control of suitable patients should have seen fit to delegate the surgical aspect of the treatment to individuals who, however great their abilities in other spheres, have little or no experience of neurological surgery. It is also to be regretted that in some of the earlier published papers little or no attention has been paid to the purely physical condition of the patients both before and after operation—a matter which is of very real importance to the individual concerned. To be cured of one illness only to fall heir to epilepsy, aphasia or incontinence is an exchange which might appeal to some but not necessarily to all.

Of the operation itself there is much to be said which is often overlooked.

Firstly, whilst the correct plane of section may be fairly accurately achieved, assuming that we are correct in believing this to be the coronal plane, the actual extent of section can never be determined with certainty. The human skull, as we

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know, varies considerably in size and shape, and so also do its contents. Even in the hands of the same surgeon the extent of section will vary considerably from case to case, and from one frontal lobe to the other in any given case. This will be so if the simplest implement, such as the brain needle I have advocated, be used. When the instrument is complicated by wire loops or moving arms the variations will naturally be even greater.

If one assumes for a moment that an identical section be made in each hemisphere, there will still be variations in the result achieved because of the differing amounts of haemorrhage on the two sides, the degree of pressure so produced upon the surrounding white matter and the extent of subsequent scarring.

It would also appear fairly certain that the more complicated the instrument devised for cutting the section, the greater is likely to be the amount of haemorrhage, oedema and scarring—and surely we should aim at the minimum of trauma compatible with effective section?

Let me state clearly that I believe this operation to produce beneficial results, but that I consider it academically and scientifically unsound. We may produce large series of excellent results when greater experience has come our way, when the indications are more perfectly realized and operative sequelae more regularly avoided, but we shall have little precise information regarding the function of the pre-frontal regions of the brain.

The injection of opaque media along the line of section can give only a rough guide as to the true extent of the operation, and there is no guarantee that the material injected has permeated to the limits of the defect made. Neither is it wise to leave in brain tissue material such as thorotrast in view of one's at present limited knowledge of its eventual end and theoretical dangers.

I would suggest therefore that this operation, valuable as it may be in individual cases, should be regarded still as an experimental procedure, justifiable only when all other available methods of treatment have failed, and when experienced psychiatric opinion is convinced that no hope of spontaneous cure remains.

I would put forward a plea that we be allowed to attempt a more soundly based experimental operation, such as the sectional removal of known convolutions of the pre-frontal regions in a series of stages, at intervals suitably placed to allow of full recovery and of physical and psychiatric assessment. Only by some such method over a period of years—and in the hands of an experienced team of workers—can the best results, both clinical and academic, be achieved.

Conclusion.

In conclusion may I thank you for the honour you have done me in inviting me to speak before you to-day. I have told you what I believe to be the truth, and regret only that I have been unable to do greater justice to the occasion.

Discussion

At the conclusion of his paper Mr. Willway said he was very interested in the clinical papers earlier in the day, and would like to hear from critics of the operation how many patients they felt had been made worse by the manoeuvre. A second point was the question of indication for early operation or should they wait for a late operation? If they could take an analogy from other surgical mutilations such as operations on the thyroid gland or on the stomach for peptic ulcer, the general history of surgery had shown that few cases were handed to the surgeon until the risks of operation were very much greater than they should have been. Few ulcers came to the surgeon until they had been given more than, perhaps, their fair share of non-operative treatment, and then as time went on the indications, and particularly the time for surgical intervention, had become increasingly clarified. Knowledge at the present stage was very nebulous on this subject of leucotomy, but as it was crystallized it should be possible at an earlier date to pick out which of the cases would respond to operative measures and they would be offered in the early stages. It was a general dictum amongst orthopaedic surgeons that no fracture should be dealt with by open operation unless closed methods had been given a fair trial first; but on the other hand orthopaedic surgeons as they worked for years on fractured limbs had learnt that certain cases would never respond to closed methods and called for open operation, and they did not, when such cases appeared, say, "I must not resort to the open operation here; I must put him through all the known closed methods until I have made certain that they will fail, as I assume they will," but proceeded at once to the short cut to relief.

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He was fascinated by Prof. Golla's hypothesis. If it was true all medical superintendents should be warned that if these patients could completely overcome any disability that this mutilation gave them, it was surely true that they were entitled to become mentally disordered again in the future, and it might be that the institutions would be refilled by all these patients in five or ten years' time. The syphilologists told him that the only criterion of cure of syphilis was the ability to produce a fresh chancre, and the only criterion of success of this operation was for the patient to be cured and to become disordered again.

Mr. E. J. RADLEY SMITH said there were one or two points he wished to make. He would like to associate himself with Mr. McKissock in regarding this as not a minor operation. It had a definite mortality and at the moment he did not see how that could be abolished. His experience was concerned with 62 cases, of which three had died, all in the first four days, of haemorrhage, and however carefully one might perform the operation haemorrhage in some cases was unavoidable. On many occasions intra-cerebral vessels were dragged out as a loop with the leucotome and had to be tied with no ill result; if they were not dragged out but were sectioned in the brain haemorrhage must follow which might prove fatal. At any rate that was the cause of death in three cases.

Fifty cases had been reported on by Dr. Dax, the results of which were variable. The operation was very imperfect, which alone accounted for much of the variation of the results. In operation on the cadaver an alarming discrepancy had been found between the actual point of insertion of the leucotome and the point where it was thought to have been inserted. Apropos of that he would like to ask other speakers whether they would get results by wider exposure of the brain or by a more careful measurement of the brain. Dr. Dax's paper tended to show —if these early results could show anything—that the psychomotor states were more important than the emotional states. It occurred chiefly to Dr. Dax rather than to the speaker that that fact might point to a section of fibres from the convex surface of the prefrontal lobe rather than a section of those fibres coming from the orbital surface. There was evidence that the prefrontal lobe had those deviations. If the results of other series showed the same result, did it imply that the fibres should be divided from the convex surface and not from the orbital surface, and, if so, should the operation be altered in some way to get at the lower fibres? It had been tried by horizontal section above the orbital surface on the cadaver in a number of instances and in two cases at operation, but it was rather too risky to say anything more about it.

Apropos of the sequelae they had not, so far, produced any epilepsy, but one case showed an isolated fit three months after operation, and that fit was accompanied by definite signs on the other side of the body of an interference with the cerebral function. That isolated fit had not been repeated, and so far there had been no other sequelae in the case. The other cases had not shown any convulsion or epilepsy.

Mr. GEOFFREY KNIGHT spoke of a series of 33 leucotomies which he had an opportunity to perform at Runwell and at the West End Hospital. All these patients were long standing and a chronic group of low potentials, deliberately selected in order that one would be certain that any post-operative change which occurred was a result of the operation and not of any spontaneous or natural means; also in order that one could study any possible harmful effects of the operation before applying it in cases of higher potentiality, and be free to use the series to estimate any difference in effect between different types of operation employed and between sections in the various planes and at different depths.

It was found in these 33 patients, despite the fact that they had been long established and had not showed any improvement under other forms of treatment, that approximately the same relative improvement was obtained as in other published series: eleven cases were not improved, eleven improved, and eleven much improved.

In regard to the type of operation employed, he naturally selected for the first nine one which appeared to give adequate effect with the least possible disturbance of tissue, and he chose the rotating blade leucotome devised by Crombie because it appeared to be an admirable instrument which caused minimal disturbance in the cortex, yet opened a considerable plane of the central core of the frontal lobe. The results of the operation were eminently satisfactory in five out of nine cases, but in two cases of paraphrenia in which the initial post-operative effect had been amazingly good with complete subsidence of hallucinosis, after six weeks the symptoms began to creep back and were attended by irritability and a certain amount of aggressiveness. It seemed as though the immediate post-operative benefit was compounded of two actions, and he wondered whether a more permanent effect might be produced if a larger procedure was used.

In the remaining cases the Freeman technique was employed in six and in the others a combination of the Freeman and Crombie techniques. It was thought that might show a significant difference either because fibres from the orbital region would be divided (on which Freeman laid great stress), or merely because of the greater quantitative effect in the numbers of fibres affected. He first of all introduced the rotating blade leucotome and then completed the operation with a blunt Freeman blade. He thought this was the safest method because after dividing the central area with the rotating blade one could feel any resistance, and if so it could be removed and inserted at a slightly different plane, which might account for the fact that he had not had a single case of haemorrhage so far.

As a further experiment in one case he deliberately employed the section further back. The patient was of a low potential in whom it was desired to obtain the maximum result, and the

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result was deplorable. Any section performed further back than 3 cm. behind the orbit was definitely dangerous and should not be used, although there was evidence that the effect of leucotomy was increased as one went further back.

It did seem that there was a quantitative difference of effect according to the total number of fibres divided, and in time it might be possible to select the type of operation performed according to requirements. Loss of initiative and spontaneity might be quite a welcome change in chronic mania, but not when it was desired to reduce obsessional neuroses. The Crombie operation was sufficient in a case of good potential, and where it was desired to produce a lessening effect in violently aggressive, long-standing cases, the more extensive operation of Freeman was likely to give more certain and permanent effects, although it was likely to be attended by slightly harmful neurological sequelae.

Major J. S. McGregor (Warlingham) said that in the absence of his surgical colleague, Mr. Crombie, he would like to say a few words in defence of two instruments with which he had something to do in their designing. The first was the rotating blade, and the other was described as an egg-whisk by Mr. McKissock. Both were designed to do the minimum amount of damage to the cortex, and in 30 cases very few complications had been produced, and certainly not epilepsy. Their findings were very much in agreement with those of Mr. Knight, who was of the opinion that the Crombie method was a reasonably safe method, while the Freeman was a more drastic procedure, probably more suitable for more deteriorated cases. At a recent meeting this question was discussed with Mr. Knight, and as a result of that discussion one case was re-operated upon which had shown an initial improvement, but which had relapsed after some six weeks, making a much bigger and more drastic enlargement, without producing any results at all.

Sir Laurence Brock said he ventured to intervene because he had an announcement to make which he felt would be of interest. He had a special interest in this question, because he was Chairman of the Burden Neurological Institute, which had done so much of the pioneer work in England. No one could read, as he had done, all the reports which had come to the Board about this operation without being struck by the extraordinary divergence in the results claimed by different hospitals in which it had been adopted. To some extent this might be due to differences in the way in which patients were chosen. Some reports almost suggested that the patients had been chosen because they were so bad that no operation could make them any worse. Anyhow, whatever the cause night be, the results reported differed so widely that the Board felt that it was most important that they should be carefully collated and analysed. As soon as circumstances permitted, it was proposed to prepare a report on the general lines of the reports made by Admiral Meagher on malarial treatment, and by Dr. Rees Thomas and Dr. Wilson on insulin and cardiazol. This could not be done during the war with a depleted staff and medical superintendents working under great pressure; but he wished to make an appeal to those who had adopted this operation that they should, so far as practicable, collect material in anticipation of the report which with their help it was proposed to prepare.

For this purpose two things were essential. One was a careful follow-up of cases after operation, not merely for three or six months, but for much longer, and the other was to do what had already been done in some cases (he thought Dr. Ström-Olsen mentioned it earlier in the discussion), and wherever possible to test the difference between the intelligence of patients before and after operation. Those who had been so fortunate as to obtain a copy of Freeman and Watts's *Psychosurgery*, a book which was difficult to get in this country, would remember the chapters by Dr. Hunt, the Associate Psychologist at the Washington Hospital, on the intelligence tests carried out there. He did not know whether the number of cases in that series was sufficient to be statistically significant. But, so far as the tests went, they seemed to indicate that, while there was some slowing down of thought processes, there was at the same time a compensating gain in accuracy. If that result was confirmed by further tests, it would be interesting and suggestive, but Dr. Hunt's results were, of course, open to the criticism that the first test was made when the patient was already suffering from mental disorder. Sir Laurence wished to suggest that, while it was extremely important that before operation and a reasonable period after operation intelligence should be tested so far as it was ever capable of being measured by batteries of tests, this should be supplemented if possible by obtaining information about the intelligence of the patient before he became ill. They could hardly expect to be so fortunate as to get hold of patients who had been submitted to the same kind of tests when they were normal, but it should be possible to obtain information about school records sufficient at least to show whether the patient before the onset of mental disorder was above or below average intelligence or merely average. Any information of this kind, and any records of personality changes obtained as the result of a careful and systematic follow-up, would add greatly to the value of the report which the Board hoped to prepare. He appealed to them, therefore, to co-operate in this task by keeping the completest possible records, hard pressed though they were; indeed, without their co-operation the report would tend to be merely statistical and to lose much of its value.

Mr. Willway, in replying on the discussion, did not quite agree that they had to know why the method worked before it was used.

Prof. J. MacDonald thought he was right in saying that Mr. Willway made a statement that there were no post-operative signs. Was that the experience of other surgeons? Was there

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any alteration in the superficial as well as the deep reflexes? Were there absolutely no post-operative neurological signs present in these cases?

Mr. WILLWAY said that it was clear that the other surgeons had not found them. Mr. McKissock had mentioned some very shocking post-operative complications; he himself had mentioned two; Capt. Lambert Rogers reported epilepsy following one case. He had not seen any change in the reflexes in any of his patients except the case in which he used the larger technique for the first time in which the patient did show an extensor response. He thought Prof. Golla should reply to the discussion; he was the clinician, while he himself was the busy surgeon, and did not always examine all the patients after he had operated. There had not been any ataxia or permanent unconsciousness, nor any disabling complication in the other cases.

Prof. GOLLA confirmed Mr. Willway's statement. All the cases were examined thoroughly and there had never been any permanent disturbance of the central nervous system.

Mr. McKISSOCK, also in reply, said that although he had measured the majority of cases on which he had operated before making the initial incision, he thought the most important thing was to look at the patient's skull and consider where the incision should be made. No series of measurements would ever give a really accurate point.

With regard to neurological signs, these certainly did occur, but in none of the cases had any of these transient signs remained permanent. He was interested to observe that after his confession of the production of four epileptics, several others had come to light.

He had nothing to add with regard to leucotomes; he still considered them barbarous.

Lt.-Col. A. A. W. PETRIE, in moving a vote of thanks to the openers of the discussions, said it gave him great pleasure to voice the sentiments of the meeting in thanking the distinguished surgeons and others who had contributed to their deliberations. Prof. Golla had given a most illuminating address, and had brought forward some interesting facts and hypotheses.

He had been particularly interested in hearing the description of the technique of the actual operation and was sure the President shared this interest.

He could not help feeling further progress would be made in this direction. Different types of cases might need somewhat different technique, and as Mr. McKissock had hinted, developments on the lines of more open operations, in specially indicated areas of the brain, might occur. This would obviate such a blind operation as was at present being performed, and he felt that the distinguished neuro-surgeons themselves would feel happier if they were able to divide the brain by more modern methods, such as surgical diathermy, and avoid tearing methods with blunt instruments, and so lessen the liability to sequelae, such as epilepsy.

He appreciated the many technical difficulties, especially as they were often dealing with a class of case upon whom elaborate operations were barely feasible owing to their disturbed conduct.

Dr. Golla had indicated that other mechanical methods of treatment might be devised, but it did seem possible that they were entering on a phase of development with neuro-surgery playing a real part in treatment.

The vote of thanks was accorded by applause and the meeting terminated.

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AN ANALYSIS OF THE MATRIX (PROGRESSIVE MATRICES) TEST RESULTS ON 700 NEUROTIC (MILITARY) SUBJECTS, AND A COMPARISON WITH THE SHIPLEY VOCABULARY TEST.

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SEVEN hundred Progressive Matrices records of male neurotic military patients admitted to Sutton Emergency Hospital between April and November, 1942, were compared with a control group (1). The distribution of the patients' scores shows a negatively skewed curve with a clustering of scores below the control median (Fig. 1).

To show the discrepancy more clearly the patients' scores have been divided into percentile grades (Table I). The grade differences are highly significant (p = less than 0·01).

TABLE I.—*Progressive Matrices. Comparison of Grade-percentages, Neurotic Group* (N = 700), *versus Control Group* (= 5072).

Grade.	Control per cent.	Neurotic per cent.
I	5	4·71
II	20	14·86
III	50	37·00
IV	20	31·14
V	5	12·29
	100	100·00

It is recognized that the lower scores obtained by neurotic subjects are partly due to unwillingness to do the test, an " easier " test situation, and to other extra-neurotic factors, but the figures given above suggest that neurotic subjects as a group are somewhat lower in intelligence than the army or civilian population generally. The results also confirmed observations made during test sessions that subjects who scored a high grade on the Matrix Test tended to be less disturbed by their neuroses on written tests of various kinds. Many of these high-scoring patients became interested in the problems in spite of their condition and took pains to arrive at correct solutions. The lower down the scale of intelligence a subject is placed, the less he seems able to deal with this kind of test, and his inability is supplemented by, or reflected in, an unwilling or careless attitude. For this reason, in clinical practice, it is commonly found necessary to check patients' scores by giving them individual tests; this is especially so at the lowest levels, *i.e.*, Grades IV and V.

So far, no reliable method of assessing the extent to which neurotic and other attitudinal factors interfere with " normal " test functioning has emerged.

On the Matrix Test the unreliability of scores is usually estimated by a comparison of scores in individual records with median scores on each of the five sets, A, B, C, D, E, at different intellectual levels. An individual's score is marked " uncertain " if, in any two sets out of the five, there is a difference of three or more points between the number of problems he gets right and the median scores in these sets for an equivalent total score. This discrepancy of three points plus or minus is, of course, arbitrary, and has to be of this magnitude before one can

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postulate unreliability, since at all score levels individual score patterns differ. It has been the practice of many testers to credit a subject with his negative score-discrepancies in the sets and thus estimate a so-called " reliable " score, or in other words, the individual's " true level " of ability on the test. This practice is arbitrary and of doubtful validity, as will be shown later.

Since there is a progressive, increasing order of difficulty in the five sections of the test, it is often assumed, quite wrongly, that all reliable records would reflect this by a downward progression of scores from Set A to Set E. The assumption is unwarranted in view of the variations of item difficulty between different individuals at the same or different levels of ability.

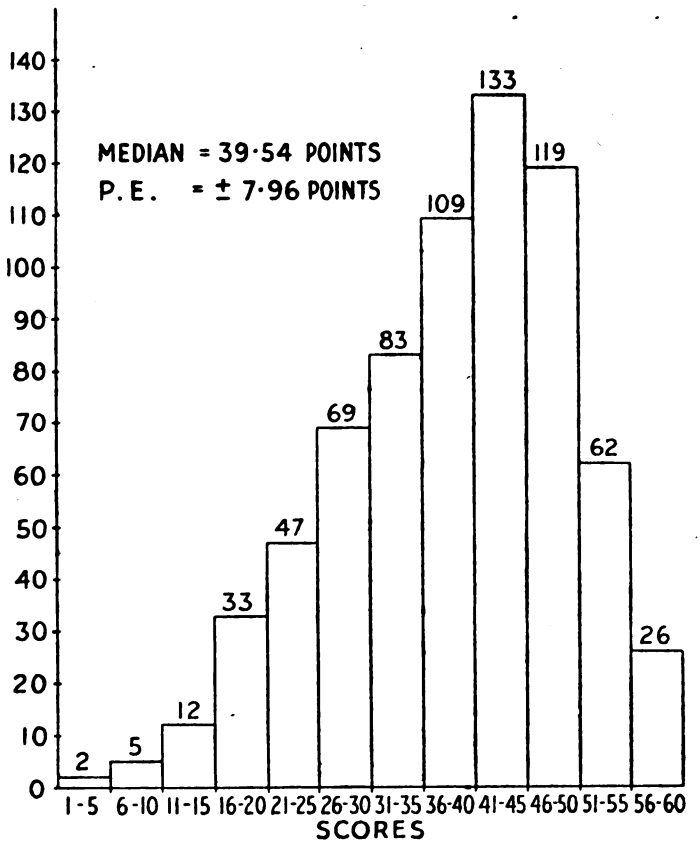

FIG. 1.

In order to test the criterion of unreliability as applied to " uneven " or fluctuating test records, the 700 records of the neurotic patients were divided into two groups, called, for convenience, "straight" and "uneven," the former showing a progressive decrease in scores from Set A to Set E, and the latter showing a reversal of scores between two or more sets. Only 40·4 per cent. (283) fall in the former category, the rest, 49·3 per cent. (417), being " uneven." Of the latter, 84·9 per cent. (354) were " uneven " in one degree, i.e., as between two adjacent sets, and 15·1 per cent. (63) were " uneven " in two degrees, involving three out of the five sets. (This is the maximum number of reversals between sets which can occur.)

In view of this excess of *prima facie* unreliable records, it was decided to make a comparison with an equal number of control records, pairing off score by score throughout the whole range. Thus equal numbers were obtained at each score level in the two groups. The control records, though chosen for comparable scores,

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were successive, random selections from over 3,000 records. In the control group an even greater proportion of " uneven " records occurred. Only 35·3 per cent. (247) showed a " straight " score progression through the five sets, the remainder, 64·7 per cent. (453), being " uneven." Of the latter, 88·3 per cent. (400) involved two sets and 11·7 per cent. (53) brought in three sets (" doubly uneven "). From these figures it appears that mere fluctuation of scores over the sub-tests is not a criterion of neurosis, for even if we assume that some of the control records came from subjects who subsequently found themselves in a neurological unit, the percentage of fluctuating records far exceeds the percentage of personnel admitted to neurosis centres. Nor is fluctuation a necessary or sufficient criterion of unreliability unless it is substantial, as already mentioned.

It was therefore thought worth while to make a further analysis of the " uneven" records in both the control and neurotic groups, to see if differences in type or degree of fluctuation occurred between them at the various score levels. Examination of the cases which were uneven in one degree only showed that the percentages at each grade-level for the two groups ran closely parallel and were not significantly different (p = 0·95), though there was a significant difference (p = less than 0·01) in the *disposition* of discrepancies over the five sets of the test. At every grade-level, in both control and neurotic groups there were considerably more reversals between Sets C and D than between other sets (Table II), the amount of reversal in a few cases being as much as eight points in both groups.

TABLE II.—*Progressive Matrices. Distribution of Score-reversals.*

(a) *Control Group* (= 400).

Reversals.	Grades. I.	II.	III+.	III—.	IV.	V.	Totals.
A to B . .	5	2	1	4	5	—	17
B to C . .	6	15	45	38	21	10	135
C to D . .	20	55	49	44	52	15	235
D to E . .	3	—	1	—	1	8	13
Totals . .	34	72	96	86	79	33	400

(b) *Neurotic Group* (N = 354).

A to B . .	3	5	11	6	13	2	40
B to C . .	7	23	28	17	10	4	89
C to D . .	18	39	40	47	41	20	205
D to E . .	3	3	2	1	2	9	20
Totals . .	31	70	81	71	66	35	354

The reason for this preponderance will be seen when we consider the order of difficulty of the 60 items in the test. Reversals between Sets B and C are next in order, the highest discrepancy here being five points. There is a tendency for reversals to occur earlier in the test as the intellectual level declines, this being partly a function of the number of items attempted in the different sets. In the neurotic group the percentage of reversals between Sets A and B is significantly higher than in the control group. If therefore unevenness *is* a sign of disturbance on the test, which depends very much on the degree of reversal in score points, then it occurs earlier with neurotics, partly because of their preponderance of lower scores.

In the " doubly uneven " cases the distribution of score reversals shows highly significant differences between control and neurotic subjects (p = less than 0·01) over the score groups. The top two grades approximate each other, but in Grade III the control group has 62 per cent. against 25 per cent. in the neurotic group, with 9 per cent. in Grades IV and V against 43 per cent. neurotics. The control group shows 81 per cent. of discrepancies between Sets B to C and C to D, as against 43 per cent. in the neurotic group, which had 36 per cent. A to B and C to D discrepancies, again indicating an earlier " disturbance." There was no significant

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difference in the *amount* of reversal between the two groups either for single or double discrepancies, so this factor does not help us *per se* to single out " neurotic " records.

A comparison of the percentages of all the " uneven " records at different score levels as between control and neurotic groups shows significant differences (p = less than 0·01) in the interval 41 to 45 ; the controls show 84 per cent. reversals as against the neurotics' 60 per cent.

The Time Factor.

The records of the control group were obtained under a time limit of 40 minutes but the neurotics had no time limit, though individual times were taken for most of the records. This affects some of our comparative figures to an unknown but probably small degree (*cf.* below). It was thought that better results might accrue from a suspension of the time limit with these subjects, who show a wide range of emotional disturbances. It is interesting to note that when 230 neurotic subjects were given the Matrix test by highly trained sergeant testers with a 20-minute time limit the scores obtained were somewhat higher than those reported above. It may therefore be advisable to time group tests even under clinical conditions, and only if this is done can there be a valid comparison with " normal " records. The imposition of a time limit may help to remove distractability, loss of interest, etc., provided there is a good atmosphere for the test.

In this section therefore only the neurotic records can be dealt with. In the " straight " records the correlation between time and score is little more than zero, with no significant differences between the median scores nor between inter-quartile ranges for different time values. In the " uneven " records there is a slight tendency for test times to increase as the intelligence level rises, but this is not significant. There is also a tendency for Grade I scorers to show a wider variation in times taken to do the test—again not significant. The median times and interquartile ranges agree closely between " straight " and " uneven " records. On the total group the Median Time is 43 minutes and the Interquartile Range 27 minutes. The shortest times recorded were between 10 and 20 minutes, with a fairly normal scatter over all score levels. The longest time taken by any subject in the " straight " group was 2 hours. Six people in the " uneven " group exceeded this, the longest period being 2 hours 45 minutes.

These results confirm the numerous reports that quickness and ability (or " speed " and " power ") on mental tests are correlated, since the average times vary little over an *increasing* score range. If we calculated a time score index for each subject we should, under normal conditions, have an indication of efficiency, as suggested by Babcock and others (2). When large numbers are being tested with a time limit, it is not practicable to record individual times, though such an index would be a useful adjunct in assessing individual cases clinically. Since we have no control figures we cannot make reliable inferences as to the relationship

Table III.—*Progressive Matrices Time-Score Indices (Average Minutes per Item)* (N = 676, *Neurotic Group*).

Score group.	Midpoint.	N.	Centiles. 25th.	50th.	75th.
56 to 60	57·5	26	1·23	0·83	0·55
51 ,, 55	52·5	62	1·13	0·91	0·64
46 ,, 50	47·5	113	1·17	0·87	0·66
41 ,, 45	42·5	132	1·40	1·06	0·81
36 ,, 40	37·5	103	1·48	1·14	0·74
31 ,, 35	32·5	80	1·54	1·21	0·95
26 ,, 30	27·5	65	2·06	1·32	0·88
21 ,, 25	22·5	45	2·46	1·75	1·13
16 ,, 20	17·5	32	3·26	2·57	1·53
11 ,, 15	12·5	11	—	—	—
6 ,, 10	7·5	5	—	—	—
1 ,, 5	2·5	2	—	—	—
		676			

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between neurosis and efficiency (in the present sense) on the test, although we know that neurotics as a group are less efficient than normal individuals. We have, however, information as to speed of functioning in the test, and this, together with qualitative remarks about individual attitudes during the test, can be very helpful clinically. For this reason we append a table (Table III) showing the Medians and Quartile Deviations in time-per-item at different score levels in our neurotic group. The time devoted to the different items of the test varies greatly and, other things being equal, is a function of the difficulty of the items to each individual. Item analysis shows different overall difficulty orders at different score levels. The composite difficulty order is shown in a later section.

When we plot time against age, again in the neurotic group only, we find hardly any correlation either in the " straight " or in the " uneven " records. The Median times and P.E's. fluctuate over the age groups, with a very slight tendency for times to increase with age. There is also a slight but insignificant tendency for a wider variation in test times to occur in the " over 30's."

Age.

The age distribution of the neurotic subjects shows a marked difference from that of the controls. Whilst 88·6 per cent. of the latter were in the 21 to 30 age group, the corresponding figure for the former is 52·5 per cent., with 35 per cent. for ages 31 to 40. There was a lag of a few months between the periods over which the two groups were tested, but this was not long enough to account for the difference, which is significant. The Median Ages for the two groups are 25·82 and 28·30 respectively. When the proportions of " uneven " records for the two groups were plotted against age levels, the differences between the groups follow the total age distributions and are therefore significantly different, but the proportions at different ages are not; the expectation of reversals between sets or sub-tests is about the same at each age from 21 to 45–50.

The records were next analysed in respect of score versus age. In both groups the correlation is little higher than zero and therefore not significant. However, by distributing scores in grades and using χ^2 as a test of significance, certain differences appeared. In the control group, a comparison of the two age groups, 21 to 25 and 26 to 30, showed a significant decrease in score with the older group (Table IV).

Table IV.

Age.	Straight records.		Uneven records.	
	Median score.	P.E.	Median score.	P.E.
21 to 25	45·0	17·6	42·3	12·4
26 „ 30	32·3	20·3	37·4	14·7

In the neurotic group there appears to be a slight downward tendency in score with increasing age from 20 to 50, but not high enough to be significant. The highest drop is between age groups 31 to 35 and 36 to 40, but as the numbers in the latter group are small ($N = 35$), we cannot assume reliability.

Attitudes to the Test.

On the whole, the Matrix Test is well taken, even in a neurological unit. A great deal depends upon the conditions under which the test is given. If it is given soon after admission to hospital, the results are adversely affected. The patients have not had time to settle down in the new environemnt. They may have travelled long distances and arrived tired, all this in addition to the symptoms for which they are referred. They may also have had preliminary interviews, blood tests, etc. It is advisable, if conditions permit, to postpone testing for a day or so. Also, much depends upon the test atmosphere, the tester, the kind of encouraging talk given before the test, the room, lighting, and so on.

For this section several thousand Matrix records from neurotic patients were examined. The tests were administered by different people, including psychologists, sisters, and nurses. No analysis has been made of scores obtained under different testers. Each person, however, administered the test along broadly similar lines,

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with individual modifications, and the tester was instructed to make notes on the record of each subject who showed a negative attitude towards the test. No remarks were made if the attitude was positive or neutral. The number of recorded cases depends upon the tester and his own attitude to the situation, the amount of his interest, observation, and other personal factors. However, every tester supplied comments incorporating his or her own observations and remarks made by patients. Of 2,500 records taken at random, only 5 per cent. (126) carried remarks on negative attitude. These were analysed with reference to complaints, score, age, and time. The complaints fell into the following categories (Table V):

TABLE V.

	Number of patients.
A. *Negativism, or "Won't" Attitudes*	
i. Resentment, aggression, sullenness, etc.	11
ii. Test regarded as a joke, as childish or humiliating; "can't be bothered" attitude, etc.	13
B. *"Can't" Attitudes.* The main theme in this group was one of inability to concentrate; this applies to all in the group, though the causes differ. The categories appearing are:	
i. Anxiety, agitation, tremors, restlessness, giddiness, twitching, palpitations	32
ii. Vision: eyestrain, blurring and shifting of test material, spots before the eyes, double vision, distortions	26
iii. Headache	24
iv. Poor comprehension of task	12
v. Depression, confusion, weeping	5
vi. Collapse	1
vii. Others	2

Most of the subjects managed to struggle through the test, but a few were unable or unwilling to continue and left the test unfinished. Occasionally one would come across amusing remarks: "It is nearly sending me balmy"; "This is ridiculous; it makes me feel humiliated"; "I don't want my brain tested"; "Next time I have anything like this to do, I shall start at the end and work backwards,"; "This is going back to infancy; I get optical illusions"; "The patterns are going round and round." A question commonly asked was, "Why are we having this; do they think we're mental?" As one would expect, the scores obtained from these patients are much lower than those of the patient groups as a whole. The median score is 19·8, as against 39·5, with a Probable Error of 18·3 as against 15·6 points. In view of these attitudes towards the test, it is difficult to estimate the reliability of the results, though with such a substantial and highly significant discrepancy one is inclined to infer that most of the complaints came from the dull and backward subjects. A division into the conventional score categories gives the following distribution (Table VI). The normal or expected percentages are given in brackets for comparison. It will be seen that over 70 per cent. of the records are in Grades IV and V, with less than 9 per cent. in the two top grades. This confirms earlier remarks on the better attitudes of higher grade subjects.

TABLE VI.—*"Complaints" Group. Distribution by Grades.*

Grade.	Percentage.	Percentage.
I	0·8	(5)
II	7·9	(20)
III	19·8	(50)
IV	36·6	(20)
V	34·9	(5)
	100·0	(100)

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Impressions received during test sessions had been that, on the whole, most of the complaints about the test came from older men, but the distribution of the 126 records shows no significant differences from the total neurotic group. The median age is 28·2 and the interquartile range 11·9 points (as against 28·3 and 10·3 respectively for the neurotic group as a whole). Moreover, the test times do not differ significantly for the " complaining " subjects. The Median Time is 46 minutes and the interquartile range 23 minutes (as against 43 minutes and 27 minutes respectively).

Estimating the Reliability of Scores.

An analysis of the Median scores and Interquartile Ranges in each of the five sets of the Matrix Test at different intellectual levels shows variations in " scatter." For this reason the present method of assessing unreliability and of estimating probable " reliable " scores is open to question, and can at any rate be improved.

The amount of trouble one is prepared to take to assess unreliability and to estimate " reliable " scores depends upon one's interest in individual cases. In clinical practice it is often deemed more convenient to use such statistical aids as are available rather than retest. For special purposes the administration of the test individually, with unobtrusive timing of items, getting the subject to verbalize his thought processes, noting his wrong choices, and in some cases taking him back through his errors, is the best procedure. A retest under group conditions may produce a different pattern of scores but a still unreliable result. However, in these circumstances one often feels justified in summing the correct answers from both sessions to get a better result.

A first step in assessing a record would be to see whether the scores in each set, when compared with group figures for the same total score obtained by the subject, fell inside or outside either the middle 50 per cent. (P.E.) or some other interval, e.g. standard deviation. A score which is within these " normal limits " would be deemed reliable, and a score outside would be regarded as unreliable. A second step would be to compare the total record with a list showing the order of difficulty of items through the whole test. Table VII shows such a difficulty order. This was obtained by plotting the frequencies of correct answers for the 60 items from 2,790 unselected control records.

If in a given record a fair number (to cover chance successes, which are in the ratio of 1 to 7 for each item over the test as a whole, and individual differences in relation to item difficulty) of successes on more difficult items appear *pari passu* with a fair number of failures on easier items, one can assume unreliability and make an assessment of the probable reliable score. Each case would have to be taken on its merits and the assessment would depend to some extent upon the tester, but he would be in possession of additional information (the difficulty order of items) to help him form an estimate. It is not possible to establish fixed criteria for this second step because of the varying individual score patterns. Also, the method presupposes that an appreciable number of items have been attempted on two or more sets of the test. It should be of service down into Grade V intellectual level. The reliability of estimates by this method of item comparison increases with the number of items attempted. Obviously, if only one set is completed, or five sets are barely attempted, any system of estimating probable scores on the test breaks down. Each of the five sets of the Matrix Test follows a logical principle, and the author of the test has made the sets as a whole increase in difficulty from Set A to Set E. There is also a fairly uniform progression within each set. Because of this progression and its particular practice or learning sequence, the use of the over-all order of difficulty is somewhat mitigated, but as far as one can judge there seems to be a strong tendency on the part of most testees to approach each item as a separate problem.* If therefore displacements of items on a record, as compared with the above rank order, are of more than one place, the judgment of unreliability is greatly strengthened, since the differences in frequency of correct scores is discriminative even between adjacent ranks. The greater the displacement of any item in either direction, the greater its unreliability as shown by rank frequencies (i.e. the number of subjects scoring correctly on the various items).

* *Cf.* Section on "Analysis of Errors."

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TABLE VII.—*Progressive Matrices. Difficulty Order of Items (N = 2,790 Controls).*

Number of item.	Frequency of successes.	Number of item.	Frequency of successes.
A1	2,790	B7	2,117
A2	2,790	D8	2,050
A3	2,788	D7	2,027
A4	2,787	E1	1,978
A5	2,783	D9	1,962
A6	2,751	C8	1,861
B1	2,737	C6	1,832
B2	2,729	C9	1,829
A9	2,694	A11	1,759
D1	2,662	B12	1,666
B3	2,658	B10	1,646
C1	2,643	E3	1,611
A8	2,631	E2	1,599
A7	2,592	B9	1,471
B8	2,567	B11	1,437
B4	2,550	D10	1,417
A10	2,539	C10	1,303
C2	2,538	C11	1,094
B5	2,517	E5	1,061
A12	2,457	D11	977
C3	2,448	E4	931
D5	2,442	E9	886
D2	2,410	E6	850
C7	2,406	E10	581
D3	2,384	E11	496
B6	2,293	D12	476
C5	2,278	E7	281
D6	2,210	C12	242
D4	2,190	E12	157
C4	2,167	E8	129

Positions of Items in Standard Sequence.

The position of each item, as above, is shown in brackets against its position in the standard sequence.)

Set A.	Set B.	Set C.	Set D.	Set E.
1 (1)	1 (7)	1 (12)	1 (10)	1 (34)
2 (2)	2 (8)	2 (18)	2 (23)	2 (43)
3 (3)	3 (11)	3 (21)	3 (25)	3 (42)
4 (4)	4 (16)	4 (30)	4 (29)	4 (51)
5 (5)	5 (19)	5 (27)	5 (22)	5 (49)
6 (6)	6 (26)	6 (37)	6 (28)	6 (53)
7 (14)	7 (31)	7 (24)	7 (33)	7 (57)
8 (13)	8 (15)	8 (36)	8 (32)	8 (60)
9 (9)	9 (44)	9 (38)	9 (35)	9 (52)
10 (17)	10 (41)	10 (47)	10 (46)	10 (54)
11 (39)	11 (45)	11 (48)	11 (50)	11 (55)
12 (20)	12 (40)	12 (58)	12 (56)	12 (59)

It is interesting to compare the standard sequence of the items in the Matrix Test with the over-all difficulty order obtained. If we plot the two sequences against each other by sets of 12 items (Table VIII), we can see the amount of displacement in the five standard sets in relation to total difficulty of items :

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TABLE VIII.—*Progressive Matrices. Standard Sequence Compared with Difficulty Order Divided into Five Equivalent Sets (Successive).*

Sets.	1.	2.	3.	4.	5.	Total.
A	**7**	3	1	1	0	12
B	4	**3**	3	2	0	12
C	0	2	**3**	6	1	12
D	1	4	4	**1**	2	12
E	0	0	1	2	**9**	12
	12	12	12	12	12	60

It will be noticed that Sets A and E, the easiest and the hardest, show the least amount of displacement of over-all difficulty. Most subjects are capable of doing all items in Set A, so that here the real difficulty order is less certain than with later items. It would be more certain perhaps if frequencies of earlier items were plotted on an isolated sample of low-grade subjects or young children. Set D shows the greatest amount of displacement, with sets B and C lying between. The table also shows clearly why there is a tendency to more reversals between Sets C and D, as already mentioned.

ANALYSIS OF ERRORS (PROGRESSIVE MATRICES).

Control records (N = 2,790) were analysed for frequencies of errors. Table IX shows the most frequently chosen wrong items. The choices depend upon several factors, such as level of ability, attitude, number of choices, possibility of choice by elimination of items already used in the pattern, and many others.

TABLE IX.—*Progressive Matrices. Wrong Items most Frequently Chosen.*

Set A.	Choice Number.	Set B.	Choice number	Set C.	Choice number.	Set D.	Choice number.	Set E.	Choice number.
1	–	1	1	1	2	1	4	1	1
2	–	2	2	2	3	2	3	2	3
3	3	3	2	3	6	3	4	3	2
4	3	4	4	4	4	4	5	4	3
5	2	5	5	5	4	5	2	5	7
6	2	6	2	6	8	6	7	6	8
7	4	7	6	7	4	7	8	7	7
8	6	8	2	8	6	8	1	8	3
9	5	9	1	9	1	9	3	9	6
10	6	10	1	10	8	10	5	10	2
11	1	11	3	11	5	11	6	11	4
12	1	12	2	12	3	12	8	12	–

"Choice number" refers to the number of one of the "pieces" at the foot of each page of the test.

In Set A all the errors are errors of perception, this set being more of a perceptual than a conceptual test, i.e. eduction of relations. Some of the errors are similar in pattern to the correct items and may have been committed through visual errors, carelessness, haste, etc. Similar remarks apply to the errors involving reversals—of whole figure, of lines, of figure-ground. Some are quantitative errors, e.g. too many or too few lines or dots. Set B shows only five "perceptual" errors (it is in this set that a change-over to eduction of correlates takes place). These again include reversals and errors of size and shape. In eight cases the choice (error) is a copy of an adjacent (discrete) part of the pattern. Inadequacy of reasoning begins rather late in this section (about B9). In Set C the number of perceptual errors is reduced to two. There are four instances of copying adjacent fragments of the design, two which might loosely be termed "clang" completions, e.g. the A.B–A sequence, as in simple tunes, and four of incomplete inference, the final step having evaded the subjects. The perceptual errors in Set D are again only two (three) in number, with three copies of neighbouring items, four "clang" completions, and four really inadequate choices with probable guessing. Finally, in Set E,

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there is only one error which might be called a perceptual error, one " clang " choice, one absolute failure (E12), the rest being failed chiefly through inadequacy of the reasoning process. There is a tendency to complete this process by elaboration, i.e. by choosing an alternative which is more elaborate than any already in the pattern—an assumption that the reasoning necessarily involves a progression of items from simple to complex.

With the lower-grade subjects, who cannot deal simultaneously with more than a very small number of variables, e.g. two or three, the errors are chiefly " perceptual," the next most frequent being due to choosing an item like the one adjacent (to the blank space); once this happens, many succeeding items are automatically failed by this follow-my-leader procedure. When subjects are tested individually it is possible to avoid some of these errors, not so much by prompting as by issuing warnings at intervals.

Most of the errors of the higher-level subjects are due to inadequacy of the reasoning process, with completion often by a " hunch." Mathematically-minded subjects seem to do as well as any on the test, and indeed some items in Set E can only be solved logically. High scores have, however, been obtained by artistic people who have an eye for form (Gestalt), symmetry, etc.

Much can be learned about a subject's attitude and mentation from a scrutiny of his errors, though this is time-consuming and can be justified only in special cases. The present, rather sketchy analysis is put forward as a supplement to information already published about this test.

Comparison with Shipley Vocabulary Test.

Of the Matrices records on neurotic subjects, 650 had comparative records on the Shipley Vocabulary Test, which was used in a slightly revised form, involving one or two minor alterations of the alternative (selective) words. Also the time limit was increased from 7½ to 10 minutes, to allow subjects to write their choice-words on a slip, instead of underlining them or giving the column number. This was necessary owing to paper shortage, and to avoid the confusion which might arise from recording column numbers on wrong lines on the slip. The modification affects the comparison with results on the older form only slightly. The increased time limit is adequate in the majority of cases. Most of those who fail to attempt all the words would be unable to do so on the original method. The depressed patients usually have adequate time to read the whole list of 40 words, and the low scorers can deal with all the words they know.

For comparison with service norms it was possible to bring in 1,326 Shipley records on neurotics. The comparative figures are shown in Table X. It will be noticed that here again there is a skewness towards the lower levels, but less so than with the Matrix Test. A comparison of the neurotic records with those of the control group grade by grade shows a less significant difference than with Matrices ($p = 0{\cdot}25$).

Table X.—*Shipley Vocabulary Test. Comparison of Grade-Percentages. Neurotic Group* ($N = 1326$) *versus Control Group* ($N = 5000$).

Grade.	Control percentage.	Neurotic percentage.
I	10	10·41
II	20	12·30
III+	20	19·70
III—	20	17·20
IV	20	25·67
V	10	14·72
	100	100·00

N.B.—In this table different gradings have been used from those shown in preceding tables.

In neurotic subjects the Shipley Vocabulary Test " holds up " comparatively well. There is little discrepancy in the two middle grades which make up 40 per cent. of the scores; the displacement is from the upper to the lower grades. Every

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patient is able to comprehend the task and, except in the lowest 5 per cent. of cases, where the score reached is only about seven words out of a total of 40, there is a fluctuating but linear progression throughout the whole range of scores.

The correlation obtained with Progressive Matrices was 0·547±0·021. This is as high as one would expect in view of the different factor loadings of the two tests.

The regression lines show a linear regression of the Shipley Test on the Matrix Test, with a slightly curvilinear regression of the Matrix Test on the Shipley Test at the lower score levels. The number of cases at these levels is small and therefore unreliable, but the curvilinearity suggests that a certain minimal level of old-established ability, as indicated by the Vocabulary Test, is needed before one can get into the stream on the Matrices Test; in other words, the bottom 5 per cent. or so on the Shipley Test do less than proportionately well on Matrices, on the average.

TABLE XI.—*Comparison of Progressive Matrices and Shipley Vocabulary Scores on Neurotic Group* (N = 650).

Shipley Grades	Matrices grades. I.	II.	III.	IV.	V.	Total.
I	**23**	20	24	2	0	69
II	17	**39**	57	9	5	127
III	22	52	**124**	42	18	258
IV	3	14	46	**46**	22	131
V	0	1	20	15	**29**	65
Total	65	126	271	114	74	650

Grade discrepancies. Number of grades discrepant.		N.	Percentage.
"Shipley" higher	4	0	30·6
	3	7	
	2	51	
	1	141	
Agree		261	40·2
"Shipley" lower	1	130	29·2
	2	56	
	3	4	
	4	0	

Table XI shows the Shipley Test plotted against the Matrix Test in grades. From this the discrepancies can be seen clearly. The discrepancy curve is almost normal. A conventional grading used for each test embraces 30 per cent. in Grades I and II, 40 per cent. in Grade III, and 30 per cent. in Grades IV and V. The discrepancies between the two tests are similarly distributed, i.e. 30·6 per cent. of total scores favour the Shipley Test, 40·2 per cent. agree as to grade, and 29·2 per cent. favour the Matrices Test; 69·4 per cent. of the discrepancies between the tests are misplaced one grade only. Using the Shipley Test as "standard" and taking each of its grades separately, we find that Grade III (the median score levels) shows the lowest percentage of scatter on Matrices (52 per cent.), and Grade I the highest (69 per cent.). If the Matrices Test is taken as a standard, Grade I scorers show the lowest percentage of variance on the Shipley Test, and Grade II the highest. From a purely positional point of view, one would expect to find the least scatter on Grades I and V, which can vary in one direction only, and most on Grade III, which can trespass into two grades, i.e. up or down. But whether we take the Shipley Test or the Matrices Test as standard, the variation shown on the correlative test at any grade level differs little from equal expectancies for each grade (p = 0·08). A comparison of the amount of scatter on Matrices shown by each grade of the Shipley Test shows the one significant difference to be in Grade I, with a higher percentage than one would expect to be caused by chance. From this result one is tempted to infer that the top scorers on the Vocabulary Test (the

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verbally facile subjects) are more disturbed by a test such as Matrices than the top scorers on Matrices are on the Vocabulary Test.

The correlation between age and score on the Shipley Test is positive but near to zero, with a slight tendency to higher scores and less variation with increasing age from 20 to 45 (50). This tendency, though not statistically significant, suggests a better stability on this test with increasing age, whether it is in attitude or in mental (verbal) organization.

Mental Deterioration.

There seems to be adequate evidence that there is a high correlation between vocabulary scores and scores on tests of " general intelligence " but most of the correlations reported are with verbal intelligence tests which include a high " V " loading. It has also been commonly accepted that in tests of deterioration the vocabulary *score* is to be used as an index of the pre-deterioration level of the patient, the argument being that a person's vocabulary is an old and early established mental habit and that it " holds up " well with age. Both these postulates are true, and the writer's own work (unpublished) on seniles shows that a score on a vocabulary test, even of the " inventive " kind where the subject has to supply his own definitions, is sometimes possible when many other tests are too difficult, even in cases where psychomotor activity is the only kind that can reliably be measured, or down to the lower limits of verbal comprehension. But in view of the wide individual differences of mental functioning, as shown by innumerable " profiles " of abilities obtained on test batteries, the discrepancy between scorers on combinations of tests and scores on a vocabulary test has to be quite marked before one can begin to suspect deterioration (3).*

The present report shows the danger of inferring deterioration from such discrepancies too readily, since almost as many subjects score lower on the Vocabulary (selective) Test compared with the Matrix Test as *vice versa*, some of the discrepancies being considerable. The same kind of thing happens with " normals." Many of the investigations on vocabulary discrepancy scores showing deterioration report group averages, and show wide deviations, indicating the breadth of individual differences. Substantial discrepancies are obtained on subjects already known to be seriously deteriorated or demented, either through natural senility or organic disturbance. In any case, one would require additional knowledge such as school and job records in order to be able to assess the pre-deterioration level. Babcock (2) has concentrated on " border-functioning " subjects in an endeavour to assess deterioration in its infancy, and she finds a relationship between score patterns (on her Deterioration Scale) and certain types of clinical patients. The present writer would like to see, in addition to thorough analyses of as many reputable tests as possible, results on representative samples of the population, between the ages, say, of 20 and 80, both on separate tests and on selected groups of tests. Wechsler (4) with his " Belle-vue " Intelligence Scale, has shown the way in this respect, since he provides figures from the age of 10 to the age of 60, and has given useful information on the normal decline of intelligence and on different ability patterns on the test at different age levels. The Matrix Test is useful in that the age range for testing is from 10 or less right through to old age. When such investigations have been done, clinicians will find themselves in a better position to attempt the assessment of mental deterioration. It is imperative that we should know the limits of normal variations as between different tests, including vocabulary tests, over a wide range of age and intelligence.

Discussion.

At the present time, when mental testing is being done on a scale unprecedented in this country, both in the Services and in the neurosis centres, a wealth of information is being accumulated in the form of test records. There is now a substantial and increasing number of reputable, well-standardized, and home-produced tests in use, especially in the Services, and psychologists have an unprecedented opportunity of analysing these tests and getting the most out of them. In the clinical field, the

* Brody takes into account the quality of the vocabulary responses as well as the score.

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personnel using such tests will appreciate as much information as can be obtained to supplement the scores and such observations on test behaviour as they can make on the spot.

The present article is an attempt to add to the existing knowledge of two widely used and well established tests, and it is hoped that the findings will be of direct use to psychiatrists, psychologists, and others concerned in mental testing.

Summary.

1. Seven hundred Progressive Matrices records from neurotic military patients were compared with controls. It was found that the neurotics as a group had significantly lower scores. Subjects at higher intellectual levels seem to take written tests better than the low-grade subjects, who often need to be re-tested individually.

2. When the records were divided into " straight " and " uneven," the latter preponderated. The control group showed an even higher percentage of " uneven " records, so that mere unevenness between the five sets is no criterion of neurosis. There was no significant difference in percentage of uneven records between different score levels in either control or neurotic groups, nor did the two groups differ significantly in amount of reversals. The neurotics showed a tendency to reversals of scores earlier in the test, partly because of their lower scores. In both groups there were significantly more reversals between sets C and D.

3. An analysis of the time factor in the neurotic group, who were tested without time-limits, showed a very low positive correlation between time and score, with no significant differences between " straight " and " uneven " records, but with a slight tendency for time and score to vary directly in the latter, there being more variation in Grade I scores. The Median Time over the whole group was 43 minutes, with a P.E. of 27 minutes. Since times do not alter significantly with *increasing* scores time-per-item decreases as score-level rises, i.e., quickness and ability are positively correlated.

Time and age showed a very low positive correlation, with a slight tendency in the " uneven " group for times to increase with age and for scores over 30 to show more variation.

4. The neurotic group showed a lower median age and wider range than the control group. The correlation between age and score is almost *nil*. The percentage of " uneven " records does not differ significantly from chance (equal) expectations at different ages in either the control or the neurotic groups, though the former shows a sigificant difference between *two* age groups, i.e. 21–25 and 26–30, the latter ages giving lower scores. There is a *very* slight tendency in the neurotic group for scores to decline with age, from 20 to 45.

5. Attitudes of neurotic subjects to the test are on the whole good, only 5 per cent. of a sample (2,500) of records showing really negative attitudes. These are analysed into various categories. There is no significant difference in age or times taken among this " complaining " group, but the low scorers show poorer attitudes towards the test. The need for good testing conditions is emphasized.

6. The current method of assessing unreliability of scores on the Matrix Test is mentioned, with further suggestions incorporating a comparison of individual records, with an over-all order of difficulty of the 60 items on the test and an index of efficiency by the use of a time-score index. A combination of methods gives the best assessments.

7. 2,790 Matrix (control) records were analysed for frequency of wrong choices. It is shown that these follow the progression of the test, i.e. broadly from perceptual to conceptual. There is a tendency for a particular wrong approach to persist amongst low-scorers through several items. Types of errors in each of the five sets are mentioned.

8. A comparison is made between 650 Shipley and Matrix records showing a normal curve of grade-displacements between the tests. The majority of these displacements are of one grade only.

9. The use of a vocabulary *score* in estimating mental deterioration is mentioned, and the danger of making facile inferences from discrepancy scores (vocabulary scores minus scores on other tests) is emphasized. There is a need for information

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about the performance of subjects over as wide an age range as possible on the more reputable tests now in use.

I wish to express my thanks to Dr. Louis Minski, Medical Superintendent, Sutton Emergency Hospital, and to Dr. W. S. Maclay, Medical Superintendent, Mill Hill Emergency Hospital, for the use of clinical material, also to the Director of Selection of Personnel, War Office, for the use of data for comparison.

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THE OBJECTIVE STUDY OF MENTAL IMAGERY.

I. PHYSIOLOGICAL CONCOMITANTS.

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ALTHOUGH much work has been done on the physiological concomitants of affective states, nothing is known of any objective bodily changes accompanying thought processes, and yet the most superficial observation of lip, facial and eye movements, of unconscious gesture and restlessness furnishes indications of some of the more obvious somatic accompaniments of non-emotional mental activity.

The present paper represents the introduction to an objective study of mental imagery. The attempt has been made, by recording the respiratory movements and cortical potentials, to correlate these observations with an independent evaluation of the form of imagery used. The type of imagery of our subjects has been elicited by a very simple questionnaire, which has frequently been perforce modified to suit the mental capacity and powers of introspection of individuals.

In a paper published in 1929 Antonovitch and Golla called attention to the connection between respiratory rhythm and the type of imagery involved in thought processes. They were convinced that the extraordinary sensitiveness of the respiratory mechanism to affective states made it very desirable that the subjects should be unaware that their respirations were being recorded if a true record of the global respiratory movement was to be obtained.

With this object in view they used a plethysmograph in the form of a large wooden case in which the subject sat with only the head outside, and the neck was rendered in airtight connection with the aperture in the lid by an inflated rubber collar. The apparatus communicated with a recording plethysmograph of four litres capacity by a very wide tube; and the whole apparatus—which, of course, recorded the total respiratory volume—was so designed as to offer practically no resistance, and was of sufficient sensibility to register the heart-beats.

The apparatus was so arranged that it was possible for the subjects to accept the suggestion that it was designed for heat recording, and the attention was thus diverted from the respiration.

As a result of these experiments it was found that there were two types of habitual respiration, approximately equally distributed among normal members of both sexes.

The irregular respiratory type was found in subjects with predominantly auditory imagery; the regular type in subjects with predominantly visual imagery.

It was thought that irregularity of respiration was the objective sign of laryngeal movements accompanying verbal kinaesthetic imagery.

For purposes of the present investigation, in which regularity and depth of respiration are the only factors considered, it was found possible to dispense with the plethysmograph in favour of a rubber sac, slightly inflated, and suitably adjusted to the thorax recording through a Marey capsule. The subjects sat upright, and in order to distract attention from the breathing, those who showed any curiosity were told that a record was being made of the pulsation of the heart.

For a limited number of experiments respiration was electrically recorded simultaneously with the electroencephalogram.

In spite of the fact that in the original paper by Golla and Antonovitch it had been noted that a distinction could be made between people whose auditory imagery consisted mainly of sound, and those in whom the sound image was accompanied by kinaesthetic sensations in the vocal organs, the full importance of this was not

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recognized at the outset of the investigation. It was thought that primary distinction between regular and irregular breathers was between those who used visual and those who used verbal imagery, but this was later found to be erroneous; the real distinction is between those with only sensory imagery and those in whom a vocal kinaesthetic component is present.

In order to elicit the prevalent mode of imagery of the subjects they were asked to perform the following tasks:

(1) A simple sum in mental arithmetic.

(2) To "see" some person or place they knew well.

(3) To "think over" to themselves the story of Red Riding Hood; (certain subjects who could not recall this story were asked to "think over" what they knew of the events that took place at Dunkirk).

(4) To "think over" their plans for some definite day (e.g. the following Sunday).

(5) To "think over" the arguments for or against some abstract proposition such as "honesty is the best policy" or "the existence of free will."

(6) To "recall" the sound of the National Anthem as played by a military band, and the sound of other people's voices.

(7) To repeat the Lord's Prayer to themselves.

It was found that in some subjects visual imagery played a preponderatingly important part in the execution of all these tests. Even in test (5), which was expected to evoke verbal imagery, pronounced visualists either saw the arguments written down or else they saw concrete illustrations of the argument, e.g. a dishonest man being sent to jail. Similarly when asked to recall the sound of the band, a visual image would accompany the sound, and the Lord's Prayer would be seen in the Prayer Book instead of being repeated verbally.

Yet other subjects varied their imagery according to the task in hand; in some visual imagery was replaced by verbal imagery for certain tasks, notably mental arithmetic and the abstract argument. Some subjects confessed to using both visual and verbal imagery concomitantly, though usually they used visual imagery alone in task (2), in which they were only asked to visualize. The vividness of the visual image and the extent to which it was employed varied considerably in these subjects. In some the image was clear, vivid, easily elicited, and usually preceded or occurred simultaneously with the verbal image; in others it was faint, fragmentary, fleeting, and usually followed the verbal image.

Finally there were those in whom the visual imagery was either very faint or absent altogether, but who used verbal imagery for all the tests 1–5 and who, in test 6, were only able to hear the tune if they sang it or hummed it to themselves.

When further enquiries were made into the nature of the verbal imagery it was found that those who were only conscious of an auditory sensation were in most cases capable of vivid visualization, whilst those whose verbal imagery had a kinaesthetic component were in most cases deficient in the power of visual imagery.

Furthermore, these subjects with auditory imagery but without consciousness of laryngeal movements were also found, like the visualists, to be regular breathers, whilst those with auditory-kinaesthetic imagery were irregular, thus further strengthening the viewpoint advanced by Golla and Antonovitch that the irregularity of the breathing is due to the restricted articulatory movements which occur in these people.

It was felt that these differences in the mode of imagery would probably be associated with differences in intellectual aptitude and in temperament. Further studies are being made in order to determine whether this is actually the case.

In view of the fact that the interpretation of colour and kinaesthesia plays such an important part in the Rorschach test, it was felt that this test, which is also one of the best character tests we yet have, would be particularly suitable for this purpose.

It is also interesting that in the evaluation of his findings Rorschach made use of the colour-movement ratio to determine the introversive or extratensive tendencies of his subjects, those with many colour responses being extraverts and with many movement responses introverts. Rorschach claimed that the movement responses were conditioned by the subject's own kinaesthesia, and that genuine movement responses did not occur unless this kinaesthetic element was present.

Now it is an interesting fact that if we take our two groups of regular and

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irregular breathers, the former group are attending to sensations apparently originating outside themselves, while their regular breathers, on the other hand, are undoubtedly attending to sensations originating within themselves. It seems possible, therefore, that the regular breathers will be found to be predominantly extratensive and the irregular breathers introversive. It will be remembered, however, that Jung found he had to enlarge his classification of introversion and extraversion, and it is almost certain that other forms of kinaesthetic imagery must be included before this problem can be satisfactorily investigated.

Too little attention has hitherto been paid to the role of kinaesthesia in intellectual processes, though the recent work by Lowenfeld on the creative activity of blind or nearly blind children, and the relation of their art to that of primitive man and the child, suggests that it is an extremely important factor. It is also significant that Rorschach associated the kinaesthetic element with creative imagination.

About 60 subjects in the present series had electroencephalographic and respiratory tracings taken and were investigated with regard to their imagery. For various reasons the group is not large enough for the results to be treated statistically, the various sub-groups being too small to yield indisputable correlation. Nevertheless the results lend confirmation to the view, already expressed by Golla and Antonovitch, and confirmed by Patterson and Wittkower, that persons with only sensory imagery, either visual or auditory, are regular breathers, while those whose imagery has a kinaesthetic component are irregular. The respiratory tracing gives no definite evidence of the presence or absence of visual or auditory imagery; it merely reveals whether or no any vocal kinaesthetic imagery is present. If the respiratory tracing is regular, the subject may be using either visual or auditory imagery or both simultaneously, while if the tracing is irregular, vocal kinaesthesia is almost certainly present, but no indication is given as to whether or no visual imagery is also present. In some people who are capable of both visual and vocal kinaesthetic imagery, the fact may be revealed if they can evoke a visual image independently of a verbal one; in these cases the record becomes regular when visual imagery alone is used, and irregular when a vocal kinaesthetic image either accompanies or replaces it. This also was found by Golla and confirmed by Patterson.

The numerical results of our observations on the relation of imagery to respiratory rhythm deal with 98 subjects (61 males and 37 females).

For our present inquiry we have considered that we can most usefully classify the habitual imagery in two types—those who are able to satisfy the examiner that they use laryngeal kinaesthetic images, and those who do not. Both types may use visual and auditory imagery.

The type using laryngeal kinaesthetic imagery is predominantly dependent on auditory images, and those without laryngeal kinaesthetic imagery use predominantly visual imagery. It is proposed to deal with the relation of auditory to visual imagery in subsequent communications.

Of the 61 males, 25 had a regular respiratory rhythm, and of these only two used laryngeal kinaesthetic images; 36 males had irregular respiratory rhythm and of these 32 used laryngeal kinaesthetic imagery.

Of the 37 females, 20 had regular respiration and none of them used laryngeal kinaesthesia; 17 had irregular respiration and 11 of these used laryngeal kinaesthetic imagery.

When, in 1935, Adrian and Matthews confirmed Berger's discovery of the alpha rhythm, they described it as "disappointingly constant." Having in mind the infinite variability of the human intellect, an experimenter would hope to find some dramatic fluctuation in cortical potentials; to be faced with an electrical rhythm even more slow and constant than any developed by the simplest tissues was certainly disappointing to the early workers. Attention therefore shifted gradually from these normal rhythms to the more dramatic phenomena associated with epilepsy and cerebral disease.

The main harvest in the clinical field has now been reaped, and interest is beginning to return to the more subtle variations on the normal theme. Two main difficulties are encountered in the study of normal electro-encephalographic records: Firstly, any correlative information which is needed about the subject's state of mind and mental dynamics depends upon his introspective skill, and the untrustworthiness of information so obtained is well known to everyone. Secondly, the records themselves (which are, of course, tracings representative of voltage

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against time) are of a form and frequency which defy accurate analysis. Numerous attempts have been made to devise some scheme whereby the alpha rhythm records could be described quantitatively so as to avoid such terms as " large," " irregular " or " persistent." Since none of these methods have proved of very lasting value there would be little profit in describing them in detail. It is sufficient to note that they all involve either a most tedious examination of the record or the inclusion of artefacts and spurious potentials in the analysis.

When this study was begun it was hoped to avoid such complications by adopting as simple a classification as possible, and up to a point the results have been satisfactory.

As a working hypothesis it was assumed that alpha records fell into three main groups :

(*a*) Those in which the alpha rhythm was extremely small (below 10 microvolts maximum), and in which for this reason the effect of opening and closing the eyes or of any such stimulus was invisible on the record.

This type of record was called " M," standing for minus.

(*b*) The next type is that in which a clearly visible rhythm of the usual size (that is from 10–50 microvolts) is present when the eyes are shut, and is blocked or greatly attenuated either by opening the eyes or by mental exertion of a fairly vigorous type. This type is called " R " for responsive.

(*c*) The last category contains those records in which an alpha rhythm of average size is present to an equal extent at all times, whether the eyes are open or shut, and irrespective of the degree of mental activity of the subject. In such records of course the delivery of stimuli is invisible, as in the " M " type, but for the opposite reason, that the rhythm is present at all times.

This type has been called " P " for persistent.

This classification takes no account of the actual frequency of the rhythm or of its form and focus. It may be called a " fundamental " classification, since it depends upon the way in which the alpha rhythm is affected by a change in physiological function. It is arbitrary also, designed rather to be tested than to mould results into its form, and it is based to a large extent upon the hypothesis that the alpha rhythm itself is a sign of inactivity in the visual association areas of the cortex—a hypothesis which may be only partly true.

The virtue of the system is that very little more time need be spent in examining the records than is usual, since it is necessary only to discover to what extent stimulation by vision or intellectual problems affects the record.

Casual observations made from clinical material before this study was commenced in earnest, strongly suggested that the type of record might be connected with the habitual imagery form used by the patient. It was suspected that people who make great use of visual imagery at all times are likely to make greater use also of their visual association areas than those in whom the visual imagery is less customary or less vivid. This type of subject would be expected to have a small alpha rhythm even in the most placid conditions. Conversely, those whose imagery was more predominantly auditory or kinaesthetic would presumably make less use of their visual association cortex, which would accordingly be left free to develop its alpha rhythm at all times and the record would be classed as " P." Between these two extremes would be those who were able to make use of visual images when necessary but were not continually, so to say, at their mercy, and in whom closing the eyes would produce an immediate relaxation of the visual integrative mechanism.

The examination was accordingly made of 60 normal subjects, as nearly as possible unselected and without any clinical symptoms of complaint.

These were all subjected as well to the inquiry into their habitual imagery, and various tests were made, as described above in this paper, to supplement their introspective data.

The records were taken under uniform conditions with a four-channel ink-writing electro-encephalograph. It was impossible to ensure complete isolation of the subject from stimuli, but the noise level did not fluctuate appreciably from day to day.

The records were taken for about a quarter of an hour for each subject and the effect of opening and closing the eyes was tested repeatedly. Whilst the eyes were closed, simple sums were given to the subjects to be done with the eyes closed, and

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the effect of this upon the record was noted. A number of different test problems were tried, but the most consistent results were obtained by giving a series of multiplication sums, starting with extremely easy ones, and working up to something a little bit too difficult for the comfort of the subject in question.

In " M " subjects no effect was visible of course, and in the " P " group also the criterion of persistence was that no amount of inspection would show when the problem was being solved or when the eyes were open, when the signals indicating these events were concealed from the examiner.

Of the two extremes—that is " M " and " P "—quite good correlation was obtained with imagery types and there were no really glaring exceptions.

The possibility of unconscious bias on the part of the observer was reduced by keeping the results of the E.E.G. unknown to those conducting the imagery tests and vice versa.

The anomalies occurred in the " R " group, and in those few whose records seemed to fall on the border-lines between the different categories.

The statistical results of the first tests are shown in Table I.

It was seen that the number of cases in the middle range is too great to permit any confident correlation. The absence of pure visual imagery types from the " P " group and of auditory kinaesthetic types from the " M " group indicates that there is some foundation for the assumption made.

It would appear to be possible that in this preliminary study the electro-encephalogram enables us to differentiate these types of behaviour. In the " P " group occur those whose preoccupation with verbal and kinaesthetic imagery is such that the opening of the eyes does not in itself constitute an adequate stimulus to activate the mechanism dealing with the integration of visual imagery and perception. In the " M " group this mechanism continues its activity when the eyes are shut, because in such subjects all mental activity is carried out with the aid of visual imagery.

In the mixed group one would appear to have a complex of at least two factors, one of which is concerned with visual perception and the other with visual imagery. In the former group the opening of the eyes initiates cortical activity, whilst in the other group activity may result from any mental effort initiating visual imagery.

The " P " group show predominantly irregular respiration characteristic of auditory kinaesthetic imagery. The " M " group show predominantly regular respiration characteristic of visual imagery.

The correlation of these electro-encephalographic results with the records of the respiratory rhythm affords indirect evidence in favour of this hypothesis.

TABLE I.

TABLE I.—*The Correlation Between Imagery Type and Electro-encephalogram.*

	V.	V. A.-k.	A-k. V.	A-k.	
" M "	13	9	—	—	22
" R "	—	12	15	—	27
" P "	—	3	6	2	11
	13	24	21	2	60

V. Number of subjects with " pure " visual imagery. V. A-k. Number of subjects with predominantly visual imagery but mixed with auditory-kinaesthetic. A-k. V. Number of subjects with predominantly auditory-kinaesthetic imagery but mixed with visual. A-k. Number of subjects with " pure " auditory-kinaesthetic imagery.

TABLE II.—*The Correlation Between Sex and Electro-encephalogram.*

	Male.	Female.	
" M "	12	14	26
" R "	31	14	45
" P "	12	4	16
	55	32	87

M. Number of subjects with records of the minus type (see text). R. Number of subjects with records of the responsive type. P. Number of subjects with records of the persistent type.

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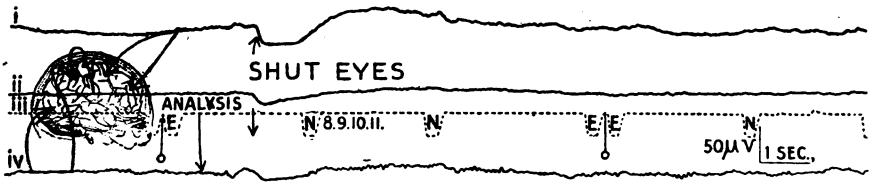

FIG. 1.—Electro-encephalograms from a subject of the "M" type. From above downwards: i, Fronto-vertical lead; ii, vertico-parietal lead; iii, analysis of iv, the parieto-occipital lead. In the analysis the small double downward deflections ("E") mark the divisions between summation epochs, each epoch being of 10 seconds. The analysis concerns the portion of record corresponding to the epoch. The single downward deflections ("N") mark off the normal alpha frequency band from the abnormal low and high frequency bands. In this case there is no alpha activity and the analysis shows only the signal marks. Compare with Figs. 2 and 3, which show humps in the normal band referable to the energy in the alpha frequencies. (Further description in text.) Electrode positions, time and voltage scale apply to all figures.

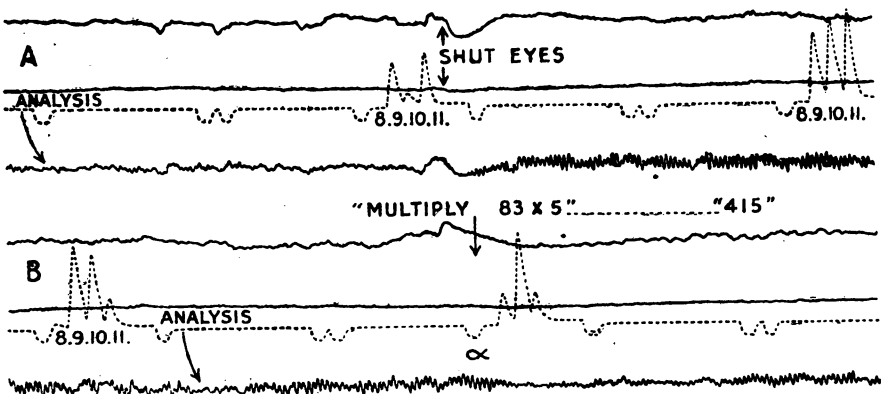

FIG. 2.—Electro-encephalograms from a subject of the "R" type. A. The effect of shutting the eyes. B. The effect of mental arithmetic. Note that the analysis shows the appearance of a large amount of energy in the alpha band when the eyes are shut. There is conversely a considerable diminution during mental effort, in spite of the inclusion in the same epoch of a large burst at 9 cycles per sec., just before the sum was given (marked "α")

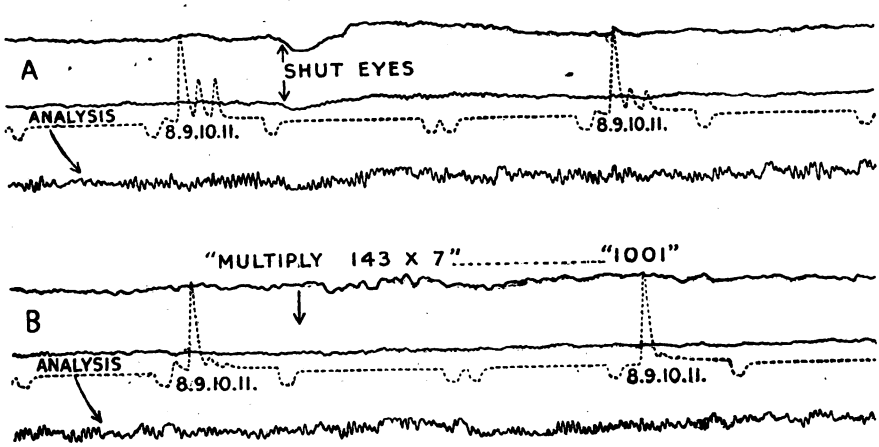

FIG. 3.—Electro-encephalograms from a subject of "P" type. A. Note the absence of any effect when the eyes are shut. B. Mental effort does not appreciably diminish the alpha energy.

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It is proposed in subsequent communications to make an intensive study of the relations between various forms of mental imagery and the electrical activity of the cortex.

The investigations will be conducted on a few subjects chosen so as to exhibit extreme forms of habitual imagery, and possessing sufficient intelligence and power of introspection to be reliable witnesses.

An intensive survey of the imagery habitual to a large number of psychotics has been initiated, with the object of discovering if there be any obvious relation between habitual imagery and the form of mental derangement. The studies on respiratory rhythm made at the L.C.C. Central Pathological Laboratory by Patterson and Wittkower are suggestive in this connection.

When these results had been collected a further correlation was noticed (Table II). There appears to be a slight but definite connection between the sex of the subject and the electro-encephalogram. The proportion of women having records of the " P " type is considerably smaller than of men; the proportion of " R " types is slightly smaller among women than among men, and the proportion of " M " types is slightly higher among women than among men.

The numbers are certainly small, but they are larger than in Table I because not all of those in this table have yet been fully studied as to their imagery. With less that several hundred subjects there may still be a possibility that the apparent correlation is due to chance, but the probability is that sex is connected in some way with electro-encephalographic type.

Very broadly stated, the relationship is that women tend to have less in the way of alpha activity than men, and this suggests that women make fuller use of their visual association areas than men do in the conditions of the examination. This may be due to a real inborn sex difference, or to a difference in education, or to a different attitude to the examination, or to some unintentional selection of subject types. These possibilities remain to be investigated, as does the similar correlation which must exist between sex and the other processes studied in this investigation.

Work is in progress on the relation between imagery and personality. For this purpose the Rorschach test has proved to be of great utility. The influence of the habitual form of imagery used on the performance in the various types of intelligence tests is being investigated at the Burden Institute in collaboration with Dr. Price of the Stoke Park Colony. The validity of such tests as a measurement of intelligence will obviously bear a very direct relation to their applicability to persons using all forms of imagery.

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APPENDIX ON A NEW METHOD OF ELECTRO-ENCEPHALOGRAPHIC ANALYSIS.

By W. Grey Walter.

In the first few cases examined, the electro-encephalograms were studied in the ordinary way, that is, by inspection of the trace, and the figures given in the table were obtained by this method. It became apparent however that something more was wanted; some method whereby the qualitative impression of " responsiveness " or " persistence " could be translated into a more quantitative form. Of the methods available the only one in the least suitable is that developed by Grass (1938), in which a separate film record is made and run through a standard wave analyser at 100 times the speed at which it was taken. This record is spliced end to end so as to create a continuous function of a form susceptible to Fourier transformation, and the resulting transform gives in effect a frequency spectrum of the record, in which the ordinates are energies and the abscissa is a frequency scale.

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The drawback of this method is that a special record must be taken for each analysis and the result is obtained only after processing of this record, which takes several minutes at least. Moreover, a considerable length of record is required, and changes which occur in the course of a few seconds would inevitably be missed, while the effect of transient artefacts and other spurious potentials is hard to detect and allow for.

A method has now been developed to overcome these difficulties—a series of tuned reeds energized by the output from the electro-encephalograph. These reeds act as frequency splitters, since each is tuned to a frequency in the band to be studied. In the complete instrument there will be 20 such reeds, covering the stretch from 1 to 20 cycles per second. In the equipment for this study only four were in use, resonating at 8, 9, 10 and 11 c.p.s., thus covering the normal alpha band. Their damping and sharpness of resonance are adjusted so that the coverage is correct for the frequency scale. Each reed is provided with a fine steel contact wire, which dips in and out of a mercury cup when the reed vibrates, but is just out of the mercury when the reed is at rest. In series with this mercury-reed contact is a high resistance, a source of EMF and a condenser. When the reed is vibrating the contact is made for a length of time, depending upon the amplitude of the vibration and upon the total number of vibrations performed in a specified time. The condenser connected to the reed is therefore charged up to a potential which is a function of the total duration of the contact time, and therefore of the amount of energy at the frequency of the reed during the specified time. A motor driven rotary switch connects an amplifier to each condenser in turn, and this amplifier drives a wide-arc recording pen across the surface of the paper on which the original electro-encephalogram is at the same time being traced. For the purposes of this study the summation epoch was chosen to be 10 seconds, and two banks of condensers are used to provide a storage register for each epoch. While one bank is connected to the reed system the other is being scanned by the motor-switch, and the pen is tracing a diagram of the charges acquired during the previous 10 seconds. At the end of the epoch the motor-switch switches the condenser banks over, so that the other bank is now scanned while the first is receiving a fresh set of charges. The pen is set back from the direct recording pens so that the analysis diagram is traced above the record to which it actually applies—that is, the stretch which was vibrating the reeds and being analysed in the previous epoch.

The details of design are fairly intricate and the adjustment is quite critical, but the effect is that each 10-second stretch of record has traced over it a histogram of its spectrum, and the shift of energy from one band to another and the quantitative rise and fall of general energy level is permanently recorded without dependence upon the opinion of the investigator. The reason for any particular spectrum can be found by referring to the record below the analysis curve, which is drawn in red ink to distinguish it from the direct record.

Although the method is still experimental, results already obtained both on normal and clinical material suggest that it may have great value. It has a similar relation to the direct record as spectroscopic analysis has to ordinary chemical methods. It is possible, for example, to analyse a record in which the brain potentials are entirely obscured by interference of one sort or another, much as a trace of haemoglobin can be detected in a dilute and impure solution of doubtful origin. In the same way rhythmic potentials can be discerned in subjects whose direct records seem entirely featureless—for example, those classed as "M." This can be done by greatly increasing the amplification, so that, although the direct record seems a meaningless jumble of irregular oscillations, the analyser shows a perfectly clear distribution of energy, characteristic of the type and responding to physiological stimuli. The possibilities and limitations of this device are yet to be defined, but it seems likely to prove the key to some, at least, of the more subtle problems raised by applied electrophysiology.

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FURTHER STUDIES ON PATHOLOGICAL WANDERING (FUGUES WITH THE IMPULSE TO WANDER).

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[Received March 29, 1943.]

THE range of psycho-pathological conditions for which the term " fugue " has been used has increased considerably and is still increasing. Originally the term was chosen to denote transitory abnormal behaviour characterized by aimless wandering and more or less marked alteration of consciousness, usually but not necessarily followed by amnesia. At present it is used for a variety of different symptoms, some of which have little in common ; the psychiatrist using the term has to define what kind of fugue he means if he wishes to avoid misunderstanding and confusion. The reasons for the great popularity of the term are manifold. It is short, handy, vague, and has even a distinguished foreign flavour. But there are other reasons apart from those virtues. When the psychological mechanisms underlying abnormal behaviour were first studied two were regarded as responsible for the origin of fugues : dissociation and escape. From that time dates the tendency to describe as fugue nearly every condition of transitory alteration of consciousness which can be understood as the result of those mechanisms. Thus a remarkable change of conception has taken place ; while the term " fugue " originally described a certain type of abnormal *behaviour* characterized by running away and wandering under a strong impulse and associated with clouding or narrowing of consciousness, it later came to be used, in addition, as the description of various results of the psychological *mechanism of escape*, without regard for the resulting behaviour. Obviously the fact that fugue means escape invited that change of conception. Considering the great number of neurotic and psychotic symptoms in the origin of which the two mechanisms mentioned above are supposed to play a part, there are hardly any limits to the use of the term. It is not intended to survey the whole literature on what has been called fugues ; a few instances from current text-books and recent articles will demonstrate for how many conditions the term has been used in recent years.

Henderson and Gillespie (1940) in their text-book use the term in accordance with the original conception and advocate a differentiation between hysterical and epileptic fugues. Mapother and Lewis (1940) use it in a much wider sense : " In the fugue the patient may live out a fantasy or simply says that he does not know who he is and where he lives." Those authors describe as hysterical fugue a loss of memory which usually is a means of evading some predicament. They add that fugues may occur as a hysterical mechanism in an organic psychosis. According to Gordon, Harris and Rees (1937), fugue is a form of massive dissociation and is always a matter of escape from conflict ; the patient " wanders off away from himself and the difficulties of his own personality." Those authors retain the conception of double personality, as do Strecker and Ebaugh (1935), while Mapother and Lewis regard it as out of date. Diethelm (1936) describes the fugue as an " oriented twilight state." Noyes and Hoyden (1940) speak of the " secondary personality " initiating the flight from ordinary life. They describe as *epileptic* fugue a state during which the patient may wander far from home, have no memory of his former or usual self and yet behave in an apparently normal way. Jeliffe and White (1926) describe fugue according to the classical concept, and so does Munzie (1940), who mentions that it is not always associated with amnesia. Hinsie and Shatzky (1940) state that in psychiatry to-day fugue means a flight from reality in which the individual enters into a state of amnesia. Some authors felt the necessity of specifying various types of symptoms. Culpin (1931) distinguished three varieties of fugues : (1) Double personality ; (2) states in which the patients are oblivious of their surroundings and dramatize scenes of their past ; (3) episodal alteration of behaviour characterized by wandering without loss of memory. Sadler (1936) differentiates the following types of fugue : The post-operative fugue, apparently meaning a delirious condition with hysterical features ; the hysterical fugue, meaning a transitory loss of memory ; the shell-shock or military fugue ; fugue related to spiritual experiences. According to him

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most fugues are phases of conversion hysteria. Apart from those conditions he speaks of periodical wanderlust, which he regards as a mild form of hysteria. Sargant and Slater (1941), in a study of amnesic syndromes in war, identify fugue with functional amnesia; they add that fugues are classical though uncommon symptoms of schizophrenia. "Typically they represent a disturbance of consciousness in which catatonic phenomena or paranoid and hallucinatory experiences dominate the patient." In the three cases of schizophrenia they observed the fugues exhibited hysterical features.

This survey shows that the following conditions have been described as fugues: States of wandering, in accordance with the classical conception; states of double personality; all kinds of transitory abnormal behaviour of functional origin; hysterical loss of consciousness and of memory; twilight states; confusional states of hysterical nature; delirious states in schizophrenia. The tendency to call transient states of altered consciousness fugues, irrespective of the behaviour of the patient, is obvious. This is a most unsatisfactory state of affairs. A term which covers such a variety of conditions ceases to be of any descriptive value. By far the best solution would be to discontinue the use of a term which confounds behaviour with mechanism. If that is not practicable the term "fugue" should be reserved for one condition only. Considering the ubiquity of the psychological escape mechanism it is clearly not recommendable to use the term as a description of the numerous results of that mechanism. An additional reason against that usage is because the escape mechanism is not the only one operative in the origin of those conditions.

The terms "poriomania," "dromomania," "periodical wandering," used in the German and Swiss literature (Kraepelin, 1913; Bumke, 1929; Bleuler, 1937; a.o.), side by side with "fugue" in the classical sense, have not been used much by British and American psychiatrists; those terms have the advantage of not inviting too wide an application, though they suggest that we are dealing not with a symptom but with a clinical entity, which is not the case. The term "wanderlust" is not quite satisfactory, as it really means "pleasure in wandering," which is actually experienced by a small proportion of patients only. Henderson (1918) spoke of "fugue-like states" when dealing with certain instances of amnesia as a defence mechanism for desertion; some of his patients had left the trenches and wandered about in a state of altered consciousness. By not calling those conditions "fugues" the author made it clear that, though the behaviour of those soldiers had certain features in common with typical fugues in the classical sense, he regarded their condition as something different. It is noteworthy that in the French literature the term "fugue" has not been used as widely as in the English-speaking countries. Janet (1907) used the term "somnambulism" for a variety of states of altered consciousness, among them wandering states. Janet's terminology was not generally accepted, obviously because it was felt that the term "somnambulism" should be reserved for the well known type of abnormal behaviour during sleep. It is clear that Janet intended to cover by the term "somnambulism" all kinds of transitory conditions with a dream-like alteration of consciousness.

As long as no agreement on a sound terminology has been reached it seems advisable to use provisionally the term "fugue" only for states of altered or narrowed consciousness with the impulse to wander; the terms "wandering states," "pathological or compulsive wandering," "poriomania," "wanderlust," though not quite satisfactory either, are equally clear. For the other conditions which are not associated with the impulse to wander and have been named fugues, other terms require to be used and, if possible, terms which describe the condition and not the mechanism, such as states of altered or clouded consciousness, clouded states, twilight states, hysterical loss of memory, hysterical confusional states, etc. Such a descriptive terminology, though less elegant than the one in general use, would have the advantage of clarity and exactness. This suggestion does not imply that in patients with fugues in the narrow sense other conditions of altered consciousness do not occur—in fact they do—but they represent different clinical features which ought to be described and studied as such. It may be argued that there are no hard and fast lines between the various conditions of altered consciousness, and that it is sometimes difficult to decide whether or not a hysterical state of clouded consciousness during which the patient walks about should be grouped with the wandering states. There certainly are borderline cases. However, in the great majority of cases with wandering states the patients are at some stage of the abnormal condition aware of the urge to wander and to keep moving; that urge usually arises from a mood

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of depression and restlessness. Furthermore, there are gradations between wandering states and vagrancy. The fact that there are, apart from the typical cases, borderline conditions, does not imply that a clear definition of the typical condition is unnecessary. There are few conditions in psychiatry and indeed in general medicine which are unrelated to and do not overlap with other conditions.

Clinical studies carried out over many years have convinced me that there is no justification in differentiating between hysterical and epileptic wandering states, as the behaviour of the patients and the majority of the etiological factors are fundamentally the same in all fugues with the impulse to wander (Stengel, 1939, 1941). If one accepted such a distinction, one would have, in addition, to describe psychopathic, schizophrenic, general paralytic and even neoplastic fugues with the impulse to wander, as in all those conditions that symptom occasionally occurs. The comparative great frequency of fugues with the impulse to wander in epilepsy is obviously due to the fact that in epileptics there is a greater tendency to transitory clouding or narrowing of consciousness, which is one of the accompaniments of pathological wandering, than in other conditions in which fugues have been observed.

It is necessary to keep in mind that the degree of amnesia following a fugue with the impulse to wander varies not only in various cases, but also in individual fugues of the same patient. The degree of clouding of consciousness is equally variable; while in some attacks the consciousness is definitely clouded, in others it is fairly clear though narrowed, i.e. dominated by one content (the urge to be on the move) to the exclusion of others.

To describe a condition as one of double personality (second *état*) is not in accordance with present-day knowledge of psychopathology. This condition seems nowadays to occur in textbooks only. In reading reports on the celebrated cases of double personality one cannot help feeling that some of them succeeded in deceiving the psychiatrist as well as the police, while others would fall into one of the well-known clinical categories. It may well be that some of them were artefacts of a bygone age of psychiatry, while in others a careful personality study would have revealed that the actions of the double were by no means foreign to the primary personality. This can be clearly seen in one of the patients (Case 36) of this case-material, whose fugues would in the past have been described as conditions of double personality.

Case Material.

In two previous studies (1939, 1941) I have reported on 25 cases of fugues with the impulse to wander (compulsive wandering), and I have been able to isolate certain aetiological factors which the cases had in common, irrespective of the underlying mental condition. Since then I have collected new case material which will give an opportunity to elaborate some of the previous findings. In one of the cases (Case 35) the investigations were based not only on psychiatric examination, but, in addition, on a careful record of self-observations covering a period of nearly five years, including a phase of compulsive wandering.

Case 26.—Mrs. R. W—, aged 32, housewife, had during the last three years left her home several times each month and wandered about aimlessly for as much as eight hours; she often found herself many miles away from her home and only had a vague recollection of what had happened during those "wandering turns." They were preceded by short periods of restlessness and depression, during which an irresistible urge to leave home made its appearance. Sometimes the patient succeeded in suppressing that impulse.

The patient had been suffering from *petit mal* attacks since she was fourteen. Those fits, many of which were observed in hospital and which could be elicited by hyper-ventilation, were particularly frequent during menstruation. The patient on many occasions injured herself during those fits and had extensive scars from burns sustained when she was cooking. The electroencephalographic examination carried out by Dr. Beevers at the Department of Neurosurgery of the Royal Infirmary, Edinburgh, revealed a dysrhythmia as found in epileptics. The fits were probably related to a head injury at the age of five. The patient had eight children. During the seventh pregnancy (in 1939) she had had fits which were regarded as eclamptic and were of a major epileptic type. Apart from the minor epileptic fits the patient had attacks of extreme excitement during which she screamed and shook without losing consciousness; those attacks were of a gross hysterical nature and were often precipitated by quarrels with her husband, who drank excessively and was unfaithful to her. Apart from increased reflexes the neurological findings were negative. The patient was subject to depressions from which she had suffered almost continuously for the last three years and which she ascribed to her unhappy

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home life. Though at first sight this appeared to be a satisfactory enough explanation, there were certain features reminiscent of the constitutional type of depression. The patient was inclined at times to blame herself for her illness, and she became very depressed and indulged in self-accusation, especially after a hysterotomy and sterilization had been performed at her own request when she was pregnant in August, 1942. That operation was indicated in view of her epilepsy and her extremely poor general condition. In her depressions the patient often thought of committing suicide and it was then that she was overcome by the urge to leave home, which at first was associated with the intention to kill herself. That intention disappeared early in the course of her wanderings. After these "wandering turns" the patient was even more depressed for some days, blaming herself for not having withstood the urge. During her wanderings she was alone.

Childhood development and family constellation.—The patient had had a happy childhood until she was seven, when her father died of encephalitis lethargica. She remembered him only vaguely. She had been very much attached to him. After his death she had lived a lonely life with her mother; she described that relationship as satisfactory.

Summary.—Fugues occurring in a patient aged 32 who had been an epileptic since adolescence and had in addition hysterical attacks precipitated by heavy emotional stress. The fugues occurred first after a pregnancy during which major epileptic fits had been frequent. The impulse to leave home and to wander arose invariably from a mood of depression. This patient has lost her father when she was seven.

CASE 27.—Miss B. R—, aged 28, domestic servant, whose home was in Edinburgh, found herself in Glasgow without having any knowledge of how she had got there. She remembered vaguely that she had gone out for a walk two days previously. She was taken to the mental hospital, where she remained for a few days. Six months previously she had had a fit in which she had lost consciousness for a few moments and broke her nasal bone. Nothing definite could be established as to the nature of that fit. The neurological examination was negative.

For the last ten years the patient had been suffering from bouts of depression of the constitutional type. She was in a state of depression when the fugue state occurred. No precipitating traumatic experience could be traced. During her two months' stay in hospital the patient had several mild attacks of depression of the constitutional type lasting for about one week. Sometimes she felt the urge to run away, but she never gave way to it.

Childhood development and family constellation.—The patient had lost her father when she was six. He came back from the last war as a sick man and died two years later. She had been greatly attached to him, and many years after the father's death she had stereotyped dreams that he was ill and needed her attention. Soon after her recent fugue state the same dream reappeared. The relationship to her mother had always been most unsatisfactory.

Summary.—Fugue occurring in a patient with cyclothymic changes of mood. There had been a fit suggestive of epilepsy six months previously. She had lost her father when she was six; she had never completely overcome a strong father attachment. The reappearance of a dream about her father needing her help after the fugue is noteworthy.

CASE 28.—Mr. D. B—, aged 27, golf-instructor, had since 1940 frequently had typical fugues with an incomplete amnesia. He used to wander about aimlessly for several days, to sleep in the open and to neglect himself completely. During 14 months he had been brought home by the police ten times; on two occasions he had been taken to mental hospitals and was released after a short period of observation. Recently he often drank during his fugues. According to his statements those conditions occurred when he was in one of the periods of depression from which he had been suffering for some years. He described them as typical depressive states of a constitutional character lasting from one to two weeks. Often he had phases of a few days' duration, when he had felt extremely happy and full of "rolling activity." During those latter periods he was very talkative and inclined to tell untrue stories about his own and his father's achievements. At the same time he wanted to drink and get money at any cost, often by pawning his belongings. Those spells of elation usually preceded the periods of depression, during which he often had felt an irresistible impulse to run away. On several occasions he had attempted suicide during the periods of depression, but he never did himself any serious harm. Sometimes the depression had been preceded by a mixed state of depression and over-activity, and in that state the urge to run away had been particularly strong. He had a vague recollection of his wanderings. "Sometimes when wandering I cursed my father upside down and wish I had my mother back. I cursed him aloud, often cry, thinking of my mother. I want to be with her." On his wanderings he had often spoken to strangers about his unhappy childhood.

Childhood development and family constellation.—The patient had had a most unhappy childhood. The father was a chronic alcoholic and completely neglected his family. He induced his wife to drink too. She had been suffering from mood swings, and during the last ten years of her life she had been almost constantly depressed and had hardly done any work. She used to drink alone. The family life had been "ghastly." The patient had been deeply attached to his mother, who died when he was 18. Between his 6th and 12th years he had lived away from home with a schoolmaster, who treated him cruelly. He had been extremely unhappy and homesick and often had wanted to run away home, which he did only once. At the age of 12

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he was taken home and had to look after his mother, who was staying in bed practically all the time.

From early childhood he had been afraid of the dark and had been a bed-wetter up to the age of ten. Later he developed symptoms of claustro- and agoraphobia, which he never completely lost. He denied being interested in the other sex. He had had male friends only, and his behaviour towards young fellow patients while in hospital suggested that he was at least a latent homosexual. He denied any conscious homosexual impulses. The patient was under observation for four months. He obviously felt secure in hospital; he had mood swings of a mild degree; sometimes he felt he wanted to escape, but he was able to control the impulse. Before entering the hospital he had formed an addiction for paraldehyde, which he gave up without difficulties.

Summary.—Fugues with the impulse to wander, occurring in a cyclothymic psychopath during states of depression or mixed states in the transition period between depression and elation. The home life had been most unhappy, owing to drunkenness of the parents. The mother had been suffering from depressions. The patient had lived away from home for six years of his childhood and had often wanted to run away home. There had been neurotic symptoms from early childhood and there were features suggestive of homosexuality. In the content of thought during the fugues his relationship to his parents played an important part.

CASE 29.—Miss R. H—, aged 22, housekeeper to her father, had since 1940 three times left her home on sudden impulse and wandered about aimlessly for one day. She had only a vague recollection of where she had been. Each time she had been depressed, felt that life was not worth living, and that she was of no use to anybody and wanted to die. The patient stated that she had been suffering from periodical mood swings ever since she was fourteen. Every year during the winter months she had been depressed for several weeks. The wandering states had each time occurred towards the end of the depression, and only once she succeeded in suppressing the urge "to get away from everything and everybody." On several occasions she had had short states of elation lasting for one to two weeks. In those states she was full of energy and happiness, most generous and expansive, and recently she has in such a period invited a number of people whom she hardly knew and wanted to entertain them without having made any arrangements. During her two months' stay in hospital she was at first mildly depressed, but soon the depression passed off and she behaved in a well-balanced manner and was pleasant and friendly to everybody.

Childhood development and family constellation.—The patient had had a most unhappy childhood. According to her aunt she was a most neglected child. The mother was pregnant with her before the marriage, which obviously was forced. The patient was an unwanted child; she was left in the care of maids and had to sleep in the servants' room. She was pitied by everybody in the village and often used to go spontaneously to other people's houses. The mother had been an invalid throughout her married life and was supposed to be suffering from heart disease. She spent most of her time in her room without taking any outside interest. From the description it seems likely that she had been either a schizophrenic or a schizoid psychopath. The father was kind to the patient but, as a result of his wife's condition, did not take much interest in family life. The patient was greatly attached to him, and when the mother died in 1940 she had the idea of keeping house for him for the rest of his life. The patient had suffered very much through her unhappy home life and felt that she had never had a real home. However, after her mother's death she did not feel happier at home than before. Though she did not openly admit it, it came as a profound disappointment to her when the father gave her to understand that he did not want her to take the mother's place and that he intended to remarry. The patient, who had behaved perfectly when in hospital during the first two months of 1943, was discharged and took up hospital nursing as a probationer nurse. She worked only for eight days, during which time she felt restless and depressed. When she visited her father's house she found that everything was different at home. She had known that the father had remarried while she had been in hospital. On the day following that visit the impulse to wander overcame her again. She wandered over the hills outside Edinburgh for many hours, and arrived back at the hospital in a condition of clouded consciousness late in the evening. When she woke up after a very long sleep she had a complete amnesia for the period of her wandering. That amnesia cleared up only gradually and incompletely.

Summary.—Fugues with the impulse to wander occurring in a patient aged 22 with cyclothymic changes of mood. The fugues occurred towards the end of depressive states. The patient had been an unwanted child and had had a most unhappy home life. The last of the fugues observed seemed to have been precipitated by the remarriage of her father.

CASE 30.—Mr. J. W—, aged 20, fitter, had first shown signs of mental change in January, 1942, one year before admission. He was moody, expressed vague ideas of reference, lost interest in his work and on several occasions left home without notice, wandered about aimlessly, slept in railway stations, and returned after one to three days in a neglected condition. He stated that he often had been feeling depressed and hopeless, and had intended to kill himself. In those states of depression the urge to leave home and to be constantly on the move had often

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overcome him. Sometimes he had had periods lasting up to a week during which he had been feeling very cheerful and happy.

Childhood development and family constellation.—The patient stated that his childhood had been most unhappy. He often felt he wanted to run away. From his fifth to tenth year he lived with his grandmother in the same town as his parents; the reason for this arrangement was that the mother, who was suffering from periodic changes of mood of the manic-depressive type, found it difficult to look after her four children. One of them died from epileptic fits at the age of two. The patient had very much resented having to live away from the parental home and has never forgiven his parents for having not kept him; even now he is full of resentment, and he expressed the feeling that his whole life would have been different if he had been allowed to live with his parents throughout his childhood. He never ceased to feel that he was an unwanted child.

During his stay in hospital the patient exhibited the symptoms described in the history. There was a general blunting of emotions. The patient was suspicious and had vague auditory hallucinations. He often was very depressed for periods of about two weeks and during those phases he disappeared from hospital on several occasions, rambling about the town and returning very late in the evening. During those depressive spells he was moody, irritable and difficult to manage, and constantly demanded to be allowed out. His recollection of the periods of wandering was very vague. He admitted on two occasions that he had intended to kill himself when going out, but that this intention had passed gradually while he was moving about.

Summary.—This is a case of schizophrenia simplex given to depressions during which the impulse to wander occurred, often blended at first with suicidal intentions. The mother was a manic-depressive and one of the siblings was an epileptic. The patient had had an unhappy childhood as the result of having to live away from the parental home for five years.

CASE 31.—Mr. M. S. M—, aged 19, miner, had within the last year twice left his parental home without reason and had travelled and wandered about for a few days. The first time he turned up in Cornwall at the house of acquaintances and asked them to keep him for good. The second time he was found wandering about in Aberdeen, having spent two nights in the open. His recollection of those happenings was only slightly hazed. According to his parents he had changed during the last three years. He imagined that people were talking about him and had been aggressive and sometimes depressed. The patient himself stated that he had often been very depressed; it was in such states of depression that a strong urge to leave home overcame him and he had left home with the intention to kill himself. As soon as he had left he felt he wanted to have a good time first, and during his wanderings the suicidal intentions soon passed off, the depression vanished and he made plans to settle away from home. During his stay in hospital the patient was moody and depressed, did not mix with others and expressed vague ideas of reference. The clinical picture was that of a schizophrenia simplex.

Childhood development and family constellation.—The patient was the 17th of 18 children of a miner. He said that he had had a most unhappy childhood and had always felt neglected and unwanted. His father was a tyrannical man, who suppressed the family. The patient had been a bed-wetter until a few years ago. He had always been a day-dreamer, and during the last years he had often dreamt of living on a farm as the only son of ideal parents. One of his sisters has been in a mental hospital for seven years, obviously with schizophrenia.

Summary.—This is a case of schizophrenia simplex in which fugues occurred during spells of depression. Three phases of the individual fugue could be distinguished: firstly, a short initial phase with suicidal intentions; secondly, the phase of compulsive wandering; and thirdly, a phase in which the patient attempted to settle far away from home. The home life had been most unsatisfactory owing to the enormous size of the family and the character of the father.

CASE 32.—Mr. R. S. R—, aged 43, labourer, had since April, 1942, on three occasions left his home on sudden impulse and wandered about aimlessly for several days, spending the nights in the open or in railway stations, neglecting himself and hardly taking any food. He had been a steady worker without abnormalities until, three years ago, his wife was killed in an air raid. From that time he had been suffering from depressions and had taken to excessive drinking. He re-married in January, 1942, but could not settle down. He became very unsteady, did not keep his job, and did not contribute anything to the upkeep of his second wife and his two children. In his depressions he often talked of killing himself. In those states the impulse to wander appeared. He used to leave his home with the intention of committing suicide, but that intention passed off as soon as he was on the move. He gave up drinking before his wandering states arose, and during his wanderings he never took alcohol and did not talk to anybody. After a few days of aimless wandering, during which he was in a hazy state of mind, he "woke up" and turned towards home in a happy mood, but his wife had locked him out since he had given up work.

His depressions showed certain features characteristic of the constitutional type. It came in bouts lasting for several weeks. When depressed he used to blame himself for his failures and for having been too strict to German civilians in 1919 when he was serving in the Army of Occupation. He regarded the death of his wife as a planned act of revenge on the part of the Germans for his behaviour in Germany, and he was convinced that they were out to kill him and

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his children too. When his depression had passed off he thought that those ideas were silly. He was under observation for some months. His mood was for some time that of depression and occasionally he wanted to escape. Gradually he settled to the routine of the hospital and was able to cope with his moods.

Childhood development and family constellation.—According to the patient his childhood had been happy. He grew up as the only son in his parents' home; both his parents had been steady and respectable people and he had been very much attached to them. He served in the Army throughout the last war without any traumatic experiences. He had been deeply attached to his first wife.

Summary.—In this case states of compulsive wandering occurred during the periods of depression when the patient contemplated suicide. The patient had been suffering from those depressions since his wife had been killed. No adverse home conditions in childhood could be established.

CASE 33.—Mr. R. M—, aged 28, colliery engineer, had, since September, 1942, disappeared from home on three occasions and had found himself in an exhausted condition 20 to 30 miles away on the following day, having walked strenuously all the time. There was a complete amnesia for that period. Occasionally he succeeded in suppressing the urge to wander. The fugues had occurred during periods of depression from which he had been suffering for some years. In these depressions, which lasted for a week and occurred several times a month, the patient felt unable to work, would sit and cry for no reason, blame himself for having made a mess of his life and contemplate suicide. He had made two attempts, one by gassing and one by jumping into the machinery of the colliery. Sometimes he had been extremely happy for a few days. "Then I am full of fun, up in the heights as if I had everything in the world." The impulse to run away had been preceded by the urge to destroy something, "sometimes another body," and on those occasions he had hit his wife. Three months before the first fugue he had had an accident in the pit; he was hit on the head and was unconscious for about an hour. He had never had epileptic fits, but had often had headaches of the type of migraine. The patient had been drinking fairly heavily for some years. He denied that he drank during periods of depressions, but admitted that he hoped to avoid them with the help of alcohol. He had been married since 1937 and had two healthy children; he described his marriage as very happy.

Childhood development and family constellation.—The patient had grown up in the parental home; both parents were stable and respectable people. He was the youngest of four children and very much the mother's boy. He described his childhood as happy, except for a period of about six months at the age of four, when the family was split up. This was the only period of his earlier days which stood out in his memory. During that time both his parents had been in hospital, the father after a severe accident, and the mother with childbirth and puerperal complications. He remembered with horror that during that time he had to live with strangers and felt most unhappy. He recollected an incident when he was beaten for trying to run away to his mother. His relationship to his parents, to whom he was greatly attached, had been satisfactory as long as he lived with them. They strongly objected to his marriage on the grounds that he was too young. His marriage resulted in a complete break with his parents. The fact that he had lost his parental home through his marriage had been a profound disappointment to him. During the last year dreams of returning home and living with his parents again appeared regularly.

Summary.—Fugues occurring in a cyclothymic man with psychopathic features. Except for a period of separation from his parents at the age of four the home life and childhood had been satisfactory. His marriage had resulted in a complete break with his parents, and there was reason to believe that this factor had played a part in the origin of the fugues.

CASE 34.—P. N—, aged 15, schoolgirl, had disappeared from her home in Edinburgh on two occasions, the first time in June, 1942; she was found a few days later in Hawick, where she had taken a job; six months later she disappeared again and was found in Devon, where she had previously been on a holiday with her parents. Her recollection for those conditions was fairly complete. She stated that she often got fed-up, was restless and depressed for some days without any particular reason and had felt a strong urge to get away from home and to be on the move. Only secondarily she decided on the place of destination. On those two occasions she had tried in vain to overcome the urge; at other times she had fought that impulse successfully. She had been a normal child up to the age of 12, when menstruation set in. Since then she had been difficult, had played truant and had become aggressive towards her mother. She had remained very much attached to her father, who was a sailor and was never at home except for short periods of leave. Recently the patient had expressed the desire to join the Navy. She used to tell fantastic lies and often stole money from her mother.

The patient stated that she had been happy at home until, at the age of six, she had to leave home and live with her grandmother, not far from her mother's home, which she visited fairly often. She was taken back home only when she was 12. She had felt that she was unwanted and that her mother was interested only in her two brothers. The reason why she had to live with her grandmother had been the birth of her younger brother. The mother had felt that she could not cope with the three children. One brother who was four years younger than the

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patient had suffered from *petit mal* attacks since he was four. The other boy, too, was an epileptic, suffering from major fits. The patient herself had never had epileptic attacks. One of her grandmothers had suffered from involutional melancholia.

Summary and comment.—This child developed psychopathic features at the age of 12, following the onset of menstruation. She played truant and was given to telling fantastic lies. On two occasions she left home under a strong impulse; she did not wander aimlessly, but decided on a destination. Her home life was characterized by the almost permanent absence of the father; from her sixth to twelfth years she had to live away from home. Both her brothers were epileptic and one of her grandmothers had suffered from involutional melancholia. This heredity is significant in view of the relationship of fugues with the impulse to wander to epilepsy and the affective reaction type. This patient is, at least for the time being, to be regarded as a borderline case between pathological wandering and vagrancy. Her abnormal behaviour is not quite typical of a fugue with the impulse to wander, though it has many features in common with that condition. It has been demonstrated in the previous communications (1939, 1941) that some patients succeeded in rationalizing their abnormal impulse, i.e. in secondarily giving it an apparently reasonable aim. This appears to have happened in this case, which demonstrates well the relationship between truancy and vagrancy in childhood and the typical wandering states. This relationship will be referred to later in this article.

Fugues with the Impulse to Wander, their Development and the Underlying Mental Condition in the Self-observation of the Patient.

CASE 35.—Miss May S. M—, aged 18, member of the women's military service, came under observation on 20.8.41.

History from father.—On 15.8 the patient had deserted from the camp where she was stationed and wandered about the country aimlessly for four days. She had joined the service as a volunteer six weeks previously. In her wanderings she had walked and travelled by train and bus about 150 miles, had neglected herself completely, had slept in cornfields and had been seduced by a stranger. Four days after she had deserted she appeared at her parents' home in an exhausted condition.

Family history.—The patient was the youngest of four children, the other three being healthy. Father described himself as healthy. The mother was "neurotic," inclined to be hypochondriacal and depressed. Two uncles of the mother had committed suicide in states of depression.

Childhood development, and family constellation.—The patient had always been difficult and a constant source of worry. During her childhood she had no settled home. The family used to follow the father, who served in the colonies as an officer of the regular army; when the patient was five months old the family left England and went to the West Indies, where the father was stationed; after two years they returned to England, often changing their domicile. After her father's retirement from the army in 1935 the family life was more organized. They were well off and lived in a big country house. May had always been very much attached to her father, but never got on well with her mother. She had been "masterful" as a baby and solitary and obstinate as a child. Intellectually and physically she had developed normally. Until the age of 12 she was educated at home by her mother and governness. When she was sent to a boarding-school at the age of 12 she felt extremely unhappy and homesick, did not want to stay and once ran away home from school; a second attempt was foiled. As she was very musical, keen on dancing and acting, and was regarded as unusually gifted, the parents gave in to her wish to take up ballet dancing. She was sent to a training school in London at the age of 14. There serious difficulties arose. Her work was good, but soon the parents heard complaints that May had stolen food. She was engaged by a ballet company. She lost her work when, in 1940, as a result of the air-raids, the company was disbanded. She had to return home.

Since her adolescence the patient has been subject to periodical depressions lasting for a few weeks and followed by short periods of extreme happiness and over-activity. While she was extremely homesick in the boarding-school she later disliked being home and gave the impression of being afraid of her parents. In recent years she had often told fantastic lies usually concerning alleged great achievements as a dancer and actress.

The patient was a well-developed girl, with pleasant manners. She was physically completely healthy. Blood sugar was normal. The intelligence test yielded an I.Q. of 104. The patient corroborated the father's statements. She said that her father had often been absent for considerable periods of time when she was a child. She had always been given to day-dreaming, and often pictured herself far away from home in foreign countries. She often felt the urge to tell fantastic lies. She hated her mother, whom she accused of always having suppressed her, but she was extremely attached to her father. He used to treat his grown-up daughters as little girls, especially May. The patient described her urge to run away as a morbid impulse from which she had been suffering for some years during her depressions. During those periods she often felt the urge to eat excessively and admitted stealing food. Recently she had been smoking excessively, and occasionally drank spirits. She felt very guilty about her desertion and the occurrences during her wanderings, and she was deeply ashamed of the disgrace she had brought on her father. Her relationship to him was illustrated by the fact that she did not resent her

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father, after her return from her wanderings, inspecting her private parts to determine whether her confession that she had had sexual intercourse was true. Though she described her state of mind during those days as strange and slightly hazy, there was no amnesia. She had during her wanderings maintained her habit of writing down everything she experienced in her diary on the same day. She said that during the days of wandering the impulse to be on the move had been uppermost in her mind, and only when on the fourth day after her desertion she heard a stranger in the 'bus mention the name of her home town she suddenly "woke up," fully realized what had happened and made her way home.

The following extracts from her diary give a clear picture of the symptoms and the personality change which had taken place during the years 1937–41. In addition, it contains a description of her mental state and her actions during the fugue. As this diary represents a unique document of high psychiatric interest it is proposed to reproduce those passages which are relevant for the description and understanding of the fugue state and the underlying condition and mechanisms.

"**1937.** 9.5: *At school. Slept very badly, wept bitterly.*—22.7: *Home!! So lovely being home.*—21.9: Had to go back to school, cried awfully, *terribly homesick.*— 22.9: Tried best not to cry but could not help it. Being terribly, terribly homesick.—25.9: Bad night. At break *ran away* to station. Policeman stopped me. School had rung up. Was motored back. Daddy came over in the afternoon. Said they were going to expel me. Felt awfully worried. Returned to school, felt perfectly awful. Most frightfully homesick, *nearly ran away again but checked myself.*—26.9: Daddy took me for a walk, whipped me. Kissed me. Left. I cried terribly.—4.10: Tried hard to be brave but felt awful. *Temptation to run away, but stopped, felt miserable.*—9.10: Told matron about feeling so homesick.—13.10: Feeling wretched.—14.10: Dreadfully tired. Cried terribly. Feeling rotten all week.—25.10: Felt miserable and cried, awfully homesick.—18.12: *Home!! Felt ready and rested. So happy.*

"**1938.** 2.2: [Training in London.] *Most homesick* the first time since I had been in London. Low in spirits and *thoroughly depressed.* Could not think of anything else, could not sleep though tired.—23.2: *Awfully depressed.*—24.2: Mrs. F. talked to me about having *taken B.'s cakes because of being hungry.* Felt very miserable.—28.2: *Depressed and awfully hungry.*—7.7: Did work in the morning. Dreadfully depressed. Suddenly exploded and burst into tears.—12.8: Was beastly to everyone and detestable to myself.—20.8: Frightful mood.—27.8: Terrible mood. Hated the family and thoroughly jealous of everyone. Cried and laughed and felt thoroughly helpless and desperately unhappy. 10.10: Depressed. Love dancing but somehow it seems so shallow.—11.11: Very depressed, prayed and sobbed.—13.12: The last week has been an awful strain. *Such a relief to be home and away from it all.*

"**1939.** 14.2: I am just *bursting with happiness.*—28.2: Packed all the evening which was terribly depressing. I am *dreading going home.*—9.3: So often now I think of all the brilliant people and what is the use of me continuing.—10.3: *Depressed.*—12.3: *So happy.*—30.5: That dreadful feeling that they are pulling me away from happiness. The parents don't understand me. *Horrible empty feeling.*—14.6: Am desperately trying to *think of some excuse not to be home* all the holidays. I *will go crazy* there.—21.6: I never want to return again [she is back at the training school]. I am *only happy away from them.* This is a dreadful thing to say but it is quite true.—24.7: I came home for dinner. *Very depressed.* Everything looks black to-night.—26.7: *A lovely mood. A wonderful feeling. I will and am going to be successful.*—29.7: *Terribly depressed.* Awful thought of going home.—8.9: Back at home. Terribly uncomfortable feeling inside. A funny mood.—9.9: Cried and cried. I can't stick it down here, it's impossible. Awful night.—16.9: A hellish day. I nearly let out a string of swear words to mummy. She treats me like a kid.—24.9: *Life is not worth living. I hate home.*—30.9: *Strange feeling. I am horribly happy and horribly depressed.*—7.10: *Hellish day. I must get away from home.* Have felt awful for ages.—10.10: Depressed, terribly depressed. Have wept all evening. Is it possible to stay here any longer? God, *I feel like suicide.*—11.10: I wish I was dead. Feel like hell. This place is hell.—18.10: Felt foul. Could not work at all. *I am going to run away.*—20.10: I am dying to fall really in love. Cried and cried. Am feeling ghastly, I am so lonely and hate it here.—21.10: Awful morning.—7.11: Feeling more content. Not as if I want to run away. It is the lull before the storm. If only I knew what some of my feelings mean it would be easier. Mummy is terrible.—12.11: Feeling frightful. Have wild idea. *Shall run away to America. Feeling like suicide or America.* A selfish mood and an awful one.—14.11: Pretty hellish and unsatisfactory day. Visions of America.—15.11: *Feel like running away somewhere to get out.* I can feel my inside boiling up. Felt damn rotten.—1.12: I always feel an awful funk going to school.—10.12: *Am so happy, terribly excited.* Went up to London. One realizes how frightful it is at home when one gets away. Free. Oh it is heaven and never, never want to go home again.

"**1940.** 12.1: Had a drink, sang all the way home.—13.1: The matinee went off well. Feeling so horribly sad, a terribly empty feeling, felt like crying my heart out. *Home is like the end of the world.*—21.1: *Tried to commit suicide. Instead wrote to G. telling him to give me some ideas how to get to America. Feeling just frightful, feel dead.*—27.1: *No feelings at all.*—30.1: Have a *mad desire to go really common,* lipstick, scarlet nails and with as little clothes as possible.

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—9.2: Back home. Feeling like hell. Felt quite mad and screamed in my room. Went out and *ran down drive, wanted to run on and on away from home.* Funnily enough *I can't remember what happened and why I suddenly felt like a lunatic. I had been having a ballet lesson before. Something must have set me off but I can't for the life of me remember.*—15.2: *My fate again. Want to run away.*—16.2: Have just had a terrible pain in my head. *I wanted to run away somewhere, no matter where as long as I ran.* Very frightening and I have cried so much, could not stop.—2.3: *In the depth of depression.*—8.3: Depression, depression, depression.—10.3: If only I could love. I prayed that I may learn to love.—18.3: Sometimes I am frightened of life, everything seems top-heavy and is going to crash on top of me.—27.3: Feeling uneasy, rather frightened, I must not do anything silly.—28.3: *In the depths of despair.*—31.3: Thoroughly depressed and wretched.—7.4: Daddy was wonderful last night. He came up to me and we just hugged. I felt so much braver and better with him. Life looked simpler, kinder, and I wasn't afraid. He is a very wonderful man.—13.4: Feeling too awful. *Had a sudden longing for death.* If only I could just sleep on never to wake up. Life is a horror.—20.4: *Life is hell.* Restless.—24.4: A day I never want to re-live. Cried buckets.—30.4: Life to-day is too, too depressing.—1.5: Dreadful this morning. Could not do anything. Didn't do anything. I shall go crackers if I stay home any longer.—10.6: *Home is hell.*—6.7: *Laughed and got on well with family.*—9.7: Wept a lot. *The future seems nothing but a black mist.* I hate everything I do and everyone.—17.7: Depressed to last degree.—7.8: Not such a bad day. *Funny day for a genius. Yes, I am a genius of acting.* I know it.—12.8: *Depression, depression.*—17.8: I wonder if I am mad. I find myself going to the window and talking to myself of the life after.—20.8: My brain and body is completely dead. To-day I lived in a daze.—5.9: Head burning. Feels too heavy for my body.—10.9: Extraordinary sensation all to-day. Just oblivion, nothing matters to me any more. *Empty, empty, empty of life.*—18.9: *Alarming day. So restless.* All keyed up inside. Cried and cried. *I live from impulse to impulse and always yearning, aching, dreaming day and night for something better. Feel to live my life so passionately, so fully that I may use up every ounce of energy.* To live to the very utmost of my ability until there remains only an empty shell drained of every life blood.—20.9: *Life is just ups and downs.* Right down in my boots again.—22.9: The family are sapping all my vitality. Unintentionally, unknowingly they are warping my heart and body. *I am quite dead.*—23.9: Better day.—25.9: Quite busy day, a practicable day. Picked apples and was useful.—27.9: Dreadful, ghastly feeling, like hell.—29.9: So unhappy. All keyed up. Frightened of myself.—30.9: *Dreadful, so very nearly ran away. Had a mad sudden desire to bicycle on and on.* Then caught sight of a policeman. I immediately felt a fool but *had to do something, so bought pounds of chocolate. I shall one day drink.*—1.10: So lovely in the early morning, so unspoiled, fresh.—2.10: *Worked ardently* in canteen, quite entertaining, *so good to be busy.*—3.10: *I am the healthy, strong one.*—11.10: *It is alarming when one is frightened of letting oneself go.*—13.10: Grim day, sick of life, feel like an ill-fed cat. Went for crazy ride alone.—14.10: I so despise men and am scared of them. So unhappy.—19.10: *Bad mood again. Heavy, heavy, melancholia.*—24.10: *Happy evening, planning intangible dreams and working out a richer, deeper future with no storms or clouds. I rather over-rate myself.*—26.10: *I want to burn with life.* To know again the quick spark of youth. Damn it, I am only 17 and like a sour grape.—29.10: I am like a damp rag with holes in.—3.11: I want to live in the rich full sense of the word. Life is so short and I am wasting it all so much.—5.11: Wretched all morning.—9.11: Bad day. Very sad and cross, selfish *depression. Over-ate.*—10.11: Things seemed all right. *Tremendous sense of power.*—12.11: Good day. Made many plans. *Was very busy and happy.*—16.11: *Horribly sad.*—18.11: Oh if I only understood. *Absolutely black.* Cried all evening, aware of ghastly, intangible hand, knocking me down, throttling, killing the very life blood.—19.11: Hellish night. I must not lose control. It would be so easy to go mad. Had to do something, so went downstairs and smoked masses of cigarettes. Tried not to drink, so went into larder and *stuffed with cakes. So full, nearly sick, any sensation is better than a continuous depression.*—21.11: Had had whisky and ate far too much. *Walked miles in deluge of rain and blackness.* Let off steam. Became jolly near drunk on cigarettes and the sensation was terrific.—23.11: To-day *contemplated suicide.* Smoked quantities of cigarettes. Drank a half glass of neat whisky. Lovely feeling of peace.—24.11: Smoked literally masses of cigarettes. Spent cash like water.—3.12: Better day.—7.12: *Thoroughly miserable. Ate masses of hateful sweets* but I just had to do something. Terribly lonely and morbid. Frightened of myself. I have no control.—6.12: There is so much to live for, 'man was created great but sin has devoured him.'—10.12: *Not a day should be wasted, for it all goes in to build up a big whole. Life is magnificent.*—12.12: *Damn it I can do anything.* I know that if one loves something it is within reach. Where your heart is there is unquenchable power. *There are so many beautiful things to learn.*—14.12: Hatefully restless.—29.12: *Extraordinarily happy to-day.* I went to evensong and *thanked God for life. Oh it is so full and there is so much to live for.*—31.12: I am gay. I have a hope for 1941. I pray that I may not get lost.'

"**1941.** 1.1: *I am bursting for experience to live passionately and fully. It's like a hammer inside me driving me on.*—2.1: *I must travel. I must keep going. I am dynamic.*—5.1: Do nothing all morning. Fierce self-analysis and such a bloody mixture. Entirely self-interested but yet I hate my faults. To-night I feel stiff, throttled.—22.1 [in London]: *I rise to heights of ecstasy. I thank God for the richness and splendour of life.* Busy up to the eyes.—23.1: I hate

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myself.—29.1: I am quite reasonably glad to be home again. It is always pleasant to live again good times. *I must keep moving.* Sex has become a stench that reeks the very streets and fouls the air.—31.1: I wish to God I were a boy.—6.2: Wish to heaven I could find the key to myself.—21.2: *Deliriously happy to-night.*—22.2: Oh Christ if father takes me home. He can't, it's mad. I am so happy.—23.2: *I must forget home.* It's a clinging leech to me. It's vile. Trying to drown me, thwart me.—9.3: *I am very happy.*—11.3: [on this day most of the company to which the patient belonged were killed in an air-raid]. 17.3: I think, think, think to no end. One day my brain will burst.—18.3: [The patient, who had lost her employment, had returned home.] *I am in high spirits for God knows what reason.* Very carefree. It has been a useless day but it does not bother me in the slightest.—20.3: *I am in a hopeless state of mind.*—21.3: I hate my fat face. Am with mother, always in the lowest spirits.—22.3: Home crushes me, it eats my soul. *Dull and black inside,* longing for God knows what. Go out all day and eat disgusting, sticky buns.—29.3: Weeping copiously. *Feel so bloody and useless.* Rush out and walk miles. Come home and feel happier.—4.4: *The world looks black.*—6.4: Black mood. Look in the mirror and *hate, loathe, and despise myself.* Smash it but am sad afterwards. I wish I could fathom these crazy whims. So awfully restless, can't explain.—11.4: Don't know what to do next. I can't explain.—12.4: If I should never get out of this place I should go mad. I would do most dreadful things, *ghastly criminal instincts.* Hating and planning, revenge and weeping. I have *pinched chocolates in masses.*—15.4: Awful wave of sheer foulness. Quite empty.—20.4: *Hell and misery. Schemed suicide.*—28.4: I lie in bed and listen to the German plane humming. A direct hit is the best solution.—30.4: Woke up last night with the *obsession to drink,* crept downstairs, pinched many cigarettes and smoked my head off. Can't bear this place any more. *Buy up masses of sugary cakes. Does not fill me up at all.* Don't even taste them.—1.5: *Get very excited, behave ridiculously and laugh at everything.*—4.5: Wonderful sunshine, *bubbling up inside with fiery ecstasy. Good to be alive. I find the family pleasant and we are very light-hearted* and I talk. Glorious walk. *I am too full of throbbing life with this surplus of hot blood running through my veins. I can give and give and still have so much reserve for myself.*—7.5: *Dreadful feeling. A flame burning and tearing me and then leaving me all cold. I am best got rid of. I am stinking.*—10.5: *Caged. There are bars all round. I am useless. I am dead.*—14.5: *I am mad. Oh this intolerable thumping and pulsing. What does it mean?*—16.5: *There is an abundance of life, everything crammed to overflowing with magnificence. There is always beauty and peace. If only I could often be able to get back into this lovely land I found to-day.* [Midnight] God what am I made of? Bad sawdust. I am laughing now and rather *wickedly happy. Hopeless, frantic, banging in my brain.*—22.5: I hate mother, I could hit her.—24.5: *Hellish mood. Want to escape.*—27.5: Eat 6 doughnuts in hedge. Feel sick.—4.6: *I loathe everything of me. I loathe this world.*—9.6: *These horrible impulses. I am terrified. It's a form of insanity. I must move,* it's a nightmare, battling against the enormous bars gradually closing in.—14.6: *Black depression and vile thoughts. After meals go in and steal more food and eat in lavatory.* Ask forgiveness and never want to do it again but I shall, I know, because at the moment it is such a relief. I can never be good.—16.6: I am hating myself more and more.—28.6: I hope I shan't feel sexual love, but love with hope and knowledge, perhaps love is hope.—5.7: *Dreadfully unhappy.* How sickening sex is. No one shall possess me.—9.7: *Blissfully happy.* Hoping to join the W.R.N.S.—21.7: *Deliriously happy. I am in love with life and the joy, oh joy of it all. Envious of sailors who see so many seas.*—22.7: *Supremely happy.*—27.7: Must enrol to-night for the duration—a problem. *Very low spirits. I am lucky, very lucky to have a home like this to fall back on.*—29.7: *Comforting to know that I have such a home, a little world utterly different.*—31.7: *Can't get out now. I'm enrolled,* better than home. It was queer last night. *Feel utterly useless.* Fatal to have the slackest job. It's terrifying—Go to T. (a town 5 miles from the camp). Come away het up. *Walk for miles, dreadful inward battle.* Want to take train to end of anywhere. Go to a church and sing alone. *Never been so beastly depressed.* The other girls are placid and logical. I'm horribly frightened like being between the devil and the deep sea. If God would only explain things in my heart.—1.8: Wake up determined. Damn tired, it's underground and my head is muzzy. Nearly go crazy with impatience. Blast it. Will there never be no light and hope? *The blindfold urge always to rush on before settling into any occupation is something imperious within, an erratic engine with inefficient brakes.* It's all a race with time to fill every fleeting moment, a thirst never quenched because there is always richer wine. That's what it is, not frantic but full. Never, never void but sharp—cannot sleep, am frightened. *Unable to explain the urge and necessity driving me on always to move. True, it is largely that griping fear which must be disguised in violent activity,* but that once conquered for a little in work does not stem the craving for a change which is not fear at all. A stinging impatience will boil up with sudden boredom of work, once fresh and interesting. The childish desire to taste everything is so fiendishly strong that one mode of life and one class of people grows in time into a fickle of emptiness. Possibly that fearsome hunger will appease with years.—2.8: Talked to the officer, asked to go to a place where there is more work. She advises me to stay on for a week. Bother!!—3.8: *Like a whirlpool.* Tossed and turned all night. Just in time for duty. I am hating it now.—4.8: I am lonely, beastly alone, sometimes I am mad and common, horrid to-day. Laugh and have good fun with the other girls—suddenly draw back, shrink from the foolishness of it all. Alarmed of the inevitable and what must come of it all. *Terribly excited watching ships, can't explain.*—5.8

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Get permission for week-end leave.—6.8 : Walking up for work. *Sudden confusion and panic.* —7.8 [*At home on leave*] : *On top of the world to-day. Am jolly and don't mind a thing.* Join in fencing class. Devilish fun.—8.8 : Dull morning. Spent money—grand feeling—buy and eat 10 sugary cakes, horribly sick. Still, I am all right now, have done something—think bad thoughts, very disturbing, talk hilarious rubbish, blast the W.R.N.S.—9.8 : Ride after lunch two hours, thinking comfortably. Enjoyable day, am placidly content. How could I take things so terribly seriously, what does it all matter ? A moody fool ! Oh it's funny ! Everything like a continuous play, drama and comedy ad infinitum.—10.8 : *Curious day. Am down in my boots again* with nothing definite to do, *pinched biscuits.* It's terrible to attend Mass and then go right back into sin : It's so impulsive. It might be anything. That's how crime is done. *Wolf a cake.* Streaking in my head. God I am mad. Incredible day, am out of my senses."

The fugue.—" 11.8 : Desire to get gross and fat so that no-one looks at me. Loathed the journey home, back to the slums [meaning the camp]. Arrive at 1.30 and change for duty—frightful surging up inside—scramble out of uniform and *bolt*, get to N. *by train free*—steady as a die now. *Walk for miles, spend money, must spend it.* Bus to T., then another to P. [20 miles away]. Beautiful trip—*wish I could go on forever moving.* It's all right then ! Walk again at P. Gets dark. Find myself in terribly bombed part, empty hush and gaping ruins everywhere, refused to hurry, plod on in and out. Run into a middle-aged Irishman. *I invent some yarn*—apparently I am in D. Walk with him to station. No train till early morning. He insists in putting me up. In bed now writing, midnight.—12.8 : At T. station [50 miles from P.]. 8.30 hungry, *have been Irish all the way down*, gibbering to two Tommies, *am thinking of my home in Ireland and believe the yarns I have spun. Queer, almost happy*, just roaming on and not caring what happens. *Gloriously light-headed, refuse to think at all. Walking, walking.* Just *in a cornfield* now, very wet and crickets are noisy. *Too dark to see*, about 10 p.m. Cold, shiver but not unhappy. Morning. Four o'clock has struck somewhere, have slept little, it rained. Strange experience. Oh I hope daddy isn't driven frantic. What shall I do until it becomes inevitable to go back ? *Yesterday was colossal. Never been through such varied emotions.* Interesting talking about life and religion to hard nut dockmen. Train journey to F. [40 miles further away]. Sunset is too, too perfect. Spend last money. Cinema with an old country woman. Get talking to Welshmen, enjoy myself hugely. Cinema again. F. is very picturesque, give a little girl chocolate and cakes, like talking to her. Oh so much has happened. Can't put down hardly anything. Cramped day. Off in bus, big rolling country, get out and walk. Big cornfield. Too cold to think. *Rather hellish night though the sky is full.* Too cold to sleep or think well. Sirens in small hours. *Incredible feeling. Entirely alone in an unknown part of the world. Don't think of what might happen next but thank God for this strange excitement. This amazing dream*—how can it all end. Sleep on book to try to keep damp out. Skirt round ankles for warmth.—14.8 : *Start walking again. Strange, strange feeling. Hitch-hike in vans to T.* Go over the Church. It is glorious, *read prayers, cry much.* Buy buns. Tea with a queer little man, amusing. Walk on main road—get lifts. One of the fellows buys me a railway ticket and buns. On platform get talking to a fire party—tough language. God, it's all fun. Oh it is an experience to remember, meeting those tough hard nuts. The queer little man is still with me. Decent chap. Tries violent love. *Am so crazy, nearly let all morals go to the wind.* Just stop and slip away—sit in the waiting room of the station all night. Soldiers bringing in tea—all rather fun. Go to ladies' room to sleep, get little but am happy. Meet everything, these common people are good sorts. Gee I'm grubby, filthy. Two o'clock in the morning taxi-driver walks in. Go out in the luxurious car. We drive at terrific pace, whizz through the night. Stop by stream. Then we get in the back and the thing is done—exhausted.—15.8 : *Home now. Have hitch-hiked up. Dreadful feeling. Disgusted to have given way to that beast.* Head like hell. I am ruined. Don't want to ever wake up. It'll break me one day. Daddy is wonderful.—16.8 : Too floppy to worry, lie in bed all limp and sad, *waiting for it to come again, this urge, burst of energy and ideas and unable to check it.* Even if the doctor can help me he won't change my fundamental make-up. *Everything hazy and disjointed. Seem to be in waking up process. The last days were good to a point and so quick with the freshness and novelty with no bad conscience hindering, for there is too much to see and hear. It's gone, miles away. Feel nothing but hell,* red hot and then an iceberg.—17.8 : Queer nasty morning. Head is like furnace. Loathely alone with those swamping, hammering things. *Down in the deepest depths.* Nothing is any use now.—18.8 : Hell—living hell ! Frightful mood to-night."

The patient stayed at home for three months ; for two months she was under psychotherapy and seemed at first to make a good adjustment ; she was able to deal with her changes of mood, though the fear of a repetition of the fugue state was always present. In the course of the treatment it became clear that her relationship to her parents was characterized by an unresolved Oedipus complex. Though her behaviour at home was fairly normal she had a strong desire to leave home and she wanted to take up residence with an old uncle who lived alone in a different part of the country. She rejoined the service after three months' leave. Nothing further was heard from her until, a month later, it became known that she had deserted again, had wandered about aimlessly for four days and was brought home in a completely neglected condition. This

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time the patient had made no notes of her experiences and had only a vague recollection. She had given up keeping a diary after the first fugue.

Summary and comment on Case 35.—This is the case of a girl, aged 19, with compulsive wandering. There was hereditary loading with depressions resulting in suicide. The patient had lacked a normal home life in childhood; the father had been away for periods of time and the family had had no permanent home. There was a very strong father fixation, while the relationship towards the mother had always been unsatisfactory. The development of the patient's character and her symptoms during the five years preceding the first fully developed fugue can be followed up with the aid of the diary. The following significant points emerge from the study of those self-observations.

Affective reactions.—The patient was given to depressions, which she experienced as home sickness when she was away from home during her 14th and 15th years. Later the depressions became more intense and they were quite obviously of the constitutional type. They lasted over periods of months, and were only rarely interrupted by short phases of a hypomanic nature. On some occasions the patient described conditions of a mixed state characterized by the presence of melancholic and hypomanic features at the same time.

Impulses.—While in the typical constitutional depression the aggressive impulses are chiefly directed against the patient himself; in this case a considerable amount of aggression was directed against external objects and especially the parents. Another unusual feature was the repeated appearance of a strong impulse to fill herself up with food; that urge was associated with a sensation of physical emptiness. The patient used to give way to that impulse and often made herself sick; that urge was responsible for the stealing of food. Later she tended to satisfy the strong oral urge by drinking and smoking excessively. Another impulse occurring in the course of the depression was the urge to run away. In her 14th year that urge drove her homewards. Later it became an impulse to run away from home or from the place of employment. Suicidal impulses occurred frequently. They usually were soon after they became conscious replaced by the impulse to run away and to wander. This transformation can be easily demonstrated in the records of her self-observations. It can be seen equally clearly that the longing for travelling into distant countries was derived from the urge to run away. Strong sexual impulses made themselves felt in the second half of the period covered by the diary. It is noteworthy that on some occasions the impulse to give herself up sexually was derived directly from the suicidal impulse.

The wandering states (*fugues*).—The fugue in the summer 1941 was not the first. There had been some abortive fugues before and many more which the patient succeeded in suppressing. One of the short fugues was followed by an amnesia, and so was the last one reported. The fugue which was recorded in the diary was not followed by an amnesia. The consciousness during that period of four days was only slightly clouded. It can be described as narrowed, while the mood and behaviour of the patient had much in common with a hypomanic condition during which the patient threw off the restrictions of moral and civilization. Occasionally the call of conscience broke through. The self-description of the pseudologia is interesting. The behaviour during her wanderings would be described by some authors as one of double personality, but the reader of the diary can easily convince himself that during the whole of that period there was no emotion and no feature in the patient's behaviour which had not been recorded previously in the diary.

The prognosis is unfavourable in this case. The increasing force of the impulses will sooner or later make permanent hospitalization necessary. The danger of suicide is considerable.

The diary, though providing a self-description of high psychiatric value, revealed hardly anything about unconscious mechanisms; in this respect such self-descriptions are usually found wanting. The technique of the diary is quite different from that of free association. It would be a mistake to regard the unresolved Oedipus complex as a satisfactory explanation of her condition, though it was one of the factors contributory in the origin of her abnormal relations to home in general. Another significant factor was the lack of a stable home environment in childhood, which may explain the lack of a normal relationship to the "nest" which is one of the foundations of human domestication in the biological sense. In addition there

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were forces at work which were rooted in the constitution, which made her, to quote her own words, "an erratic engine with inefficient brakes." This case proves once more the multiplicity of factors co-operating in the causation of fugues with the impulse to wander.

Some of the features recorded in the self-description are of interest from the psycho-analytic point of view. Freud and Abraham in their studies on the unconscious mechanisms in melancholia have laid particular stress on the abnormal organization of the oral libido component in that condition. A regression to a very early phase of libido development in which the process of oral introjection of external objects is all important was regarded as significant. In this patient the appearance of a strong oral urge and its intimate connection with the symptoms of depression were very obvious. The patient showed in her behaviour a remarkable difference as compared with the typical melancholia; while the melancholic patient tends to refuse the intake of food, this patient had the impulse to fill herself up with food and thus to overcome the feeling of complete emptiness. There is another significant difference between this patient and a typical melancholic case which may be usefully described in psycho-analytical terms; the typical melancholic in turning his aggressive impulses against the introjected external objects is bound to turn them against himself. The fact that in this case so much of the aggressive impulses was directed against objects in the outer world could be understood as the result of the incompleteness of the process of introjection; the insatiable oral urge may be another expression of the incompleteness of that mechanism in this case. It may well be that an analysis on those lines may lead to an understanding of the difference between typical melancholic patients and such cases of constitutional depression which are given to impulses such as described in this case material.

A Case of Post-encephalitic Parkinsonism with Typical Fugues with the Impulse to Wander and Atypical Fugues during Oculogyric Crises.

Case 36.—Mr. T. H—, aged 34, commercial traveller, admitted in May, 1940. He was an advanced case of post-encephalitic parkinsonism with frequent oculogyric crises. He had had at the age of 13 a typical encephalitic lethargica, diagnosed in the acute stage by Prof. Bramwell at the Royal Infirmary, Edinburgh. He recovered from the acute illness within two months and went to school up to the age of 15, when he took up clerical work. From the age of 16, when he was still physically healthy, he had had periods of depression lasting for one to two weeks. During those depressions he often felt a strong urge to leave home and to travel and wander about for two or three days. He only rarely succeeded in suppressing that impulse. His recollection for those wandering states which occurred once or twice a year was very vague. He described his state of consciousness during his wandering as dazed. He gave up his sedentary work and took up commercial travelling, as he wanted to move about the country as much as possible. At the age of 22 he had to give up work owing to the development of Parkinsonism. At the age of 23 he had the first oculogyric crisis; those attacks increased in frequency, and during recent years he has had them several times a week. He felt restless and depressed during the days preceding the attacks, which lasted up to 12 hours unless terminated by hypnotics. The patient described his content of thought during those attacks as follows: "I want to run away from this place to my mother as if she was not dead; sometimes I want to run to my aunt. I have to get away. I am terribly frightened. I think they want to kill me. I am fed up with life. In the turn I often visualise my mother as I saw her lying in bed before she died. I shout 'Mother' and I think if I had a mother I would be O.K." The patient used to be most violent during the oculogyric crises, used to fight violently to run away and had as a rule to be put into a straight jacket. He often shouted the name of his aunt and of his mother.

Childhood development and family constellation.—The patient's mother had died in childbed when he was only 2½. He was the only child. He stated that he could remember seeing her before she died. Immediately after her death he was taken over by an aunt, who had been looking after him ever since. His father remarried and did not take any interest in him. The patient had always felt an orphan, although his aunt had been very good to him. Ever since his illness the thought that if his mother had been alive he would not be ill had been in his mind with the persistency of an obsession.

Summary and comment on Case 36.—This is a case of post-encephalitic Parkinsonism in which for some years fugues with the impulse to wander had occurred during states of depression. Since the patient had been suffering from oculogyric crises the impulse to run away appeared during those attacks, resulting in violent attempts to break out. The patient was quite unable to suppress those impulses

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during the oculgyric crises which were associated with fear of death. During those attacks the idea of running to his mother or aunt occurred in a stereotyped way.

The history of this case shows quite clearly that the main features of the behaviour of the patient during the oculogyric crises had developed from a typical fugue with the impulse to wander. It is difficult to say whether those typical fugues and the underlying depressions from which the patient had suffered prior to the development of the parkinsonism had been a remote result of the encephalitis. This possibility cannot be excluded considering that encephalitis lethargica leads to lack of resistance to impulses, and in view of the less well-known fact that periodic depressions are not infrequent in post-encephalitic patients. The early environmental factors which were found in a great majority of cases with wandering states, i.e. the lack of a normal home life in childhood, were very obvious in this case; its importance was demonstrated by the contents of thought during the oculogyric crises. The motor and mental behaviour of the patient during those attacks was obviously complex determined.

A relationship between the typical fugue with the impulse to wander and the form of automatic motor behaviour similar to that demonstrated in this case has been described in Case 2 of this series (1941), in which a picture characteristic of " epilepsia procursiva " was demonstrated as a " condensed " fugue. The running automatism during the oculogyric crises of Case 36 can be understood in the same way. Its intimate relationship to the previous typical fugues is even clearer than in the case of the epileptic patient, owing to the longer duration of the oculogyric crisis. The similarity of the mechanisms in both cases is also of interest in view of the assumed relationship between epileptic attacks and oculogyric crises. The fact that individual experiences determined the mode of behaviour during the crises has been demonstrated in a number of cases (Stengel, 1930; Jelliffe, 1932). The alteration of consciousness regularly associated with oculogyric crises offers a favourable condition for all kinds of complex determined behaviour.

Some Remarks on Fugue-like States in Children; Their Relationship to Vagrancy and to the Fugues of the Adults.

In the two previous communications on the subject of fugues with the impulse to wander I have drawn attention to the fact that vagrancy in childhood and the wandering states of the grown-ups are not only on the surface but genetically related, and I have expressed the opinion that war conditions which so amply provide one of the factors operative in the aetiology of those symptoms, i.e. the break-up of home life, may result in an increase of those conditions. Recent observations in children have borne out the correctness of both statements. I have within a short time seen three female children under 10 years of age who, following the departure of the father owing to war service, periodically disappeared from home and wandered about aimlessly for some time. Their behaviour had much in common with the fugue of the grown-ups. In those children the conscious thought of looking for or following the absent father played an important part in the origin of the abnormal behaviour. A similar mechanism could be traced in some adults reported previously. Case 34 demonstrates that fugue-like states may be preceded by truancy in childhood.

It is not intended to provide on this occasion full reports on those children or to enter into a discussion of those problems. They form the subject of a special investigation which is being carried out together with Dr. L. F. W. Eickhoff.

General Comment.

It is not proposed to restate and discuss on this occasion the clinical features which the cases, presented in this article, have in common with those previously reported (1939, 1941). The reader is referred to these papers. Only certain points will be further elaborated. This new case-material shows afresh that fugues with the impulse to wander occur in a variety of conditions. The relationship to some cases of epilepsy was similar to that demonstrated previously. In all cases the impulse to wander had emerged from a state of depression or from a mixed state with depressive and hypomanic features. The state of depression was not just a preliminary to the fugue, but a period with abnormal affect during which sometimes the urge to wander arose. The transformation of a suicidal

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impulse into the impulse to wander could be clearly demonstrated in a number of cases. This clinical observation is of importance in trying to understand the significance of the symptom. M. Schmideberg (1936), Henderson (1939, 1942), myself (1939, 1941), and lately H. Wilson (1942) have expressed the opinion that the fugue is a symbolic suicidal act. I have drawn attention to the fact that though nearly all those patients had contemplated, and some of them attempted, suicide, only one patient actually killed herself. Obviously the fugue with the impulse to wander takes the place of suicide. These considerations lead up to two problems: (1) Into which category does the fugue with impulse to wander belong? At first sight it seems that the symptom is of a purely hysterical nature. It is complex determined, and it has been shown in the previous communications that the wandering is not as aimless as it appears to be; but this is only one aspect of the symptom. While it is probably true that no fugue with the impulse to wander develops without hysterical mechanisms entering into the multiplicity of the aetiological factors, it would not be justified to regard them as hysterical symptoms of the kind of a conversion hysteria as some authors have done. Apart from the fact that powerful constitutional factors of a kind not operative in the conversion hysteria play a part in the aetiology of fugues with the impulse to wander, it is doubtful whether one should classify a certain type of impulsive behaviour as a conversion symptom only because it has a symbolic meaning and appears to serve the purpose of overcoming emotional tension. This use of the term "conversion hysteria" is not in accordance with the original conception of that condition. It is true that some of the hysterical conditions which have been loosely called fugues, e.g. a motionless state with loss of consciousness, can be regarded as conversion symptoms; but a fugue with the impulse to wander is a symptom of a different nature. It has certain features which we associate with psychotic symptoms; the patient acts under a strong impulse with little liberty of interference, and for a time completely severs his normal relation to the outer world. The symbolic nature of abnormal actions can be seen in psychotic as well as neurotic conditions. The fugue with the impulse to wander is only very rarely precipitated directly by a preceding overt psychic trauma as are some hysterical conditions which have been called fugues. The fugue in the narrow sense is not a purely hysterical symptom. It is a condition of a type which only the coincidence of neurotic and psychotic mechanisms can produce.

As to the constitutional factors which take part in the aetiology of the symptom, the additional case-material has proved the importance of the constitutional depressive element. The behaviour during the fugue itself often shows a mixture of depression and restricted over-activity. However, in viewing the whole of the affective reactions of those patients it cannot be overlooked that there are certain features which are not typical of the melancholic depression, i.e. the appearance of certain primitive impulses and the direction of the aggressiveness towards external objects. The possible dynamic significance of those features in the depression has been discussed in the comment on Case 35. The hope may be expressed that a study of those atypical features of affective reactions may lead to an understanding of certain features in psychopaths; their depressive reactions, though of a constitutional nature, do not fully conform to that typical of manic-depressive conditions.

The new case-material presented bears out the importance of a disturbance of the relationship to home in the aetiology of the wandering states. A gross disturbance of home life in childhood could be established in all cases except two. The one was Case 33, who began to wander after his wife had been killed; the fugues appeared to be a reaction to the destruction of his own home, which occurred in adult life. It can be assumed that a deeper investigation would have explained why the patient reacted to this trauma in this unusual way. In Case 34 the disturbance in home life in childhood had been comparatively short, but considering the age in which it occurred and the circumstances involved it may have been sufficient a trauma to act as one of the aetiological factors in the causation of the fugues when the patient as a grown-up experienced the virtual loss of his parents once again as a result of his marriage. To prevent misunderstanding I want to make it clear what is meant by disorder of home life operative in the aetiology of fugues with the impulse to wander. Freud's contention that in the aetiology of hysteria an unresolved Oedipus complex can be traced fairly easily in a great

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majority of cases still holds good. It could be argued that, if not more can be found in the history of fugues with the impulse to wander than this familiar situation, there would be nothing specific about the environmental factors. But there *is* more to be found than an unresolved Oedipus complex. It can be demonstrated in the great majority of the case-histories that home life had been permanently or transitorily of such a kind that an Oedipus complex could not develop at all, with the result that what I called " the relationship to the nest " and " the biological process of domestication " had been disturbed. Reference has been made to this aspect in the comment on Case 35. This case adds to the knowledge of the possible varieties in the disturbance of home life in childhood.

Recent studies on factors in suicidal attempts are of considerable interest in connection with those problems. Palmer(1941) found in a study of 25 consecutive cases of suicide that unavailability of one or both parents exerted a malign influence and increased suicide proneness. A total of 16 out of 25 cases had lost a parent before the age of 14, 11 of them the parent of the other sex. Reitman (1942), examining an equal number of cases of attempted suicide with various psychotic or neurotic conditions, could verify Palmer's findings, and pointed to the importance of those results for the problem of the predicability of suicide. Considering the relationship between fugue with the impulse to wander and suicide, it is remarkable that the early environmental factors increasing suicide proneness are the same as those found in the development of fugues. Palmer's and Reitman's findings call for further investigations in a larger case material.

The question arises why the same environmental conditions contribute in some cases to the origin of wandering states or vagrancy, in other to the increase of suicide proneness, while in a further group of cases they appear to contribute to the development of delinquency. It has been shown in these studies that abnormal environmental conditions in childhood become pathogenetic only in co-operation with other aetiological factors. It is very likely that the differences in the consequences of the same environmental conditions are due to the differences in the other pathogenetic elements operative on the aetiology of abnormal behaviour. Further research is necessary to clarify those problems.

Conclusions.

A plea for a clear and exact terminology on states of altered consciousness has been entered and a restriction in the use of the term " fugue " has been advocated.

Eleven more cases with a variety of psychiatric conditions and exhibiting the symptom of fugue with the impulse to wander have been reported, in addition to the case material presented in two previous communications. A tendency to depressive reactions of the constitutional type has been observed in all cases, even in those in which the underlying mental illness was not of manic-depressive nature.

The problem of the aetiological factors operative in the origin of the fugue with the impulse to wander has been re-examined, and the significance of certain environmental and constitutional factors outlined in the previous communications has been confirmed and further elaborated. More varieties of environmental conditions in childhood and adult life contributing to the development of the symptom have been reported and analysed.

The relationship of the symptoms to the affective reaction types, to epilepsy, hysteria, pseudophantastica and other psychopathic features has been demonstrated. Certain atypical features of the depressions from which the impulse to wander arose and the personality types in which it occurred have been demonstrated and discussed in the light of psychiatric and psychoanalytic experiences and theory.

Extracts from records of self-observations available in one of the cases, and describing the experiences during a fully developed fugue with the impulse to wander as well as the mental conditions from which the symptom arose, have beenre produced and analysed.

A case of post-encephalitic Parkinsonism in which typical fugues with the impulse to wander had made their appearance some time after the acute encephalitis has been reported, and it has been shown that the behaviour of the patient during oculogyric crises could be understood as a fugue with the impulse to wander, modified by the associated organic symptomatology.

Fugue-like states in children have been reported. In those cases the environ-

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mental conditions were similar to those which have been found to play an important part in the aetiology of the fugues with the impulse to wander in grown-ups.

The symbolic meaning of the fugue with the impulse to wander and its relationship to suicide has been demonstrated and discussed. Attention has been drawn to recent investigations on suicide proneness and the predictability of suicide, which suggests that the environmental conditions in childhood increasing suicide proneness in adult life are the same as those operative in the aetiology of the fugues with the impulse to wander.

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AETIOLOGICAL FACTORS AND REACTION TYPES IN PSYCHOSES FOLLOWING CHILDBIRTH.

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RE-EXAMINATION of the various problems arising from psychoses following childbirth is of interest for various reasons. Firstly, their place in the system of psychiatry is far from clear; their original description under the term "puerperal insanity" (Kraepelin) had given rise to the idea that they represented a clinical entity. According to Kraepelin the great majority of these psychoses take the form of catatonic states and only a few are of the manic-depressive group. More recent investigators, however, have shown that there is no psychotic reaction peculiar to childbirth (Clarke, Kilpatrick and Tiebout, Zilboorg, Saunders, James, Strecker and Ebaugh, Harris, Karnosh and Hope, and Piker). In these contributions the importance of the accompanying environmental and sociological factors has also received consideration.

Secondly, the question arises whether the recent advances in chemotherapy, as related to the prevention and cure of puerperal sepsis, have had a material influence on the incidence of psychotic reactions in the puerperium.

Thirdly, it has to be considered whether shock therapy is indicated in the treatment of those cases. Other available methods have also to be discussed. An evaluation of therapeutic measures is possible only on the basis of a sound knowledge of the various clinical facts which permit of an assessment of the prognosis in each case. Though there is general agreement that the prognosis in psychoses of the puerperium is relatively more favourable than in similar psychoses not associated with the puerperium, Henderson and Gillespie, adopting Adolf Meyer's psycho-biological principle, have pointed out that the prognosis in each individual case depends on a great complexity of factors—the type of the psychosis, and the sum total of all the constitutional and environmental influences.

Fourthly, the question will have to be discussed whether our knowledge of the various aetiological factors contributing to the origin of the psychoses following childbirth is adequate to indicate a basis for preventive treatment. Considering the frequency of those psychoses and their far-reaching social implications, this is a problem of the highest importance for preventive and social medicine. The statistical data of the frequency of psychoses following childbirth vary; Clouston found that they constituted 5 per cent. of the female admissions to mental hospitals, while Kraepelin's figure was 7 per cent, and more recently Zilboorg gave the figure of 8·7 per cent.

In this paper it is proposed to deal with the above-mentioned problems on the basis of observations collected from 21 cases—a material sufficient to demonstrate the various reaction types and the influence of certain aetiological factors and mechanisms. In addition, a further 131 cases have been surveyed for statistical purposes. It is not intended to deal with psychotic reactions developing during pregnancy or in the later periods of lactation or with neurotic reactions to childbirth.

The case-reports of the 21 cases presented will be given only in brief, with the exception of a few representative cases, which will be given in more detail. If not specially mentioned, the pregnancy will have been normal.

CASE 1.—*A depressive state with nihilistic ideas and suicidal tendencies occurring during the first puerperium of a married woman aged 28, with marked psycho-sexual immaturity and an unhealthy home background which prejudiced her against childbirth and led her to have abnormal*

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fears about pregnancy and delivery. A hatred for her child also originated from this home background. Neurotic reaction of husband to the pregnancy. Recovery in two months with electric convulsion therapy.

On admission she presented the picture of a melancholic depression with depersonalization, a condition which had developed acutely on the second day of the puerperium. There was no confusion or clouding of consciousness and her orientation was perfect. A clearly defined hypochondriacal element amounting to a delusional system ran through her content of thought. "I don't know how I'm still alive. Bits of me have died away. Everything seems unreal." Her outlook was one of utter hopelessness and misery, and she was preoccupied with suicidal ideas. She said she was hollow, that her food did not go down the right way, that it never reached her stomach. According to her statements, which were corroborated by her relatives, the existing condition was an exacerbation of a depression which had been present for three months before the delivery. At that time she had expressed fear of childbirth, had become depressed and had remarked that she wanted to die. She tried to carry out an abortion by inserting a knitting needle into her cervix, but the only result was a haemorrhage, which frightened her considerably. A week later she said that immediately after a "big sneeze" she had become conscious of a hollow feeling in her abdomen. This delusion persisted throughout the succeeding months of the pregnancy, and remained as one of the main features of her condition on admission. In addition, she expressed the idea that she had a lump in her breast which had disappeared inside her abdomen after the "sneeze." She feared this lump might be cancerous. Her mother had died of this trouble, and the patient had been told that it had developed in connection with a breast abscess occurring during the mother's last puerperium. For this and other reasons to be referred to later, the patient did not want to have a child. She vomited throughout the pregnancy and this symptom became more persistent after the "sneeze." In spite of her depression her behaviour remained apparently normal throughout the pregnancy.

Previous history.—Her mother died when the patient was 13 from cancer of the breast, and her illness left a lasting impression on her mind. Being the eldest of the four children, she was left at that early age to take the mother's place in the home. The father, a harsh, intemperate man, left the home to live with a married woman, though he always provided them with adequate financial support. To add to the patient's difficulties, the youngest brother was delinquent. According to her husband she has always been of a cheerful, uncomplaining disposition, but she has had repeated episodes of mild depression.

She met her husband six years before their marriage, which was strongly opposed by her father on account of a consumptive history in the man's family. When they were married no intercourse took place for five years, the patient maintaining that she was afraid of being hurt and of becoming pregnant. Mutual masturbation was practised until the husband threatened to leave her. Thereafter she submitted reluctantly to intercourse. After the second intercourse she became pregnant. It is noteworthy that her husband, who is of obvious neurotic disposition, showed considerable nervous anxiety with persistent vomiting throughout his wife's pregnancy.

Progress.—At first the patient remained inaccessible and resented any attempt to encourage her, but gradually she became more co-operative. Eight weeks after the delivery electric convulsion therapy was initiated and she received six treatments within two weeks. After the second treatment the improvement was remarkable, and at the end of the course she had developed good insight into her condition, lost her hopeless outlook on life, had developed a normal maternal instinct and was interested in the baby. Her improvement continued and she was discharged two months after admission. She has remained well since and there has been no further conflict about the child.

CASE 2.—*A depressive state with melancholic features and slight clouding of consciousness occurring in a woman aged* 30. *Hypochondriacal ideas associated with the death of her mother and sister alleged to have resulted from childbirth. The patient has a psychopathic personality and her husband is a chronic invalid.*

She believes she is suffering from cancer of the womb, the disease of which her mother died after having had nine children. Her sister had died of puerperal fever after her second delivery. She was a difficult child and has an unstable personality. She married two and a half years ago. Eight months after her marriage she had a full-time stillborn child. This did not upset her unduly, but her husband had a breakdown precipitated by the disappointment. Throughout their married life her husband has been suffering from rheumatoid arthritis, which has rendered him a chronic invalid. In view of this, she felt it was unwise for her to have a child.

She was a co-operative patient and she responded readily to psychotherapy. She made a good recovery and was discharged ten weeks after her admission.

CASE 3.—*A severe melancholic depression with depersonalization and nihilistic ideas in a primipara aged* 28, *with a history of a mild melancholic depression six years previously. The child was not wanted, and had been the source of conflicts on the ground of different religious beliefs adhered to by the patient and her husband.*

On admission her content of thought was as follows: "I was born without a soul and without any instinct. I am as good as dead. Nobody believes me because I can speak but my words are all empty. If you could only put me in a box and burn me. My life was all a pretence. Somebody ought to kill me."

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At the time of her marriage, a year before her admission, her husband, a Protestant, had to agree to bring up their children in the Roman Catholic faith. In spite of this agreement, however, their religious differences still occupy an important place in their lives. Partly because of those differences and partly because her husband was serving in the Armed Forces, the patient did not want to have a baby.

She made a good recovery five months after delivery, a course of electric convulsion therapy having been carried out during the fourth month post partum.

CASE 4.—*Acute agitated melancholic depression with initial confusion occurring in a married primiparous woman aged 26, after delivery by Caesarian section of a full-time anencephalic monster. An unhappy childhood resulting in neurotic behaviour. Complete recovery in three months.*

On admission her content of thought was as follows: "I'm not Mrs. C—. I can't be Mrs. C—. I am no good. . . . I have let him down. . . . Let me die. . . . You must not let them come and cut me up. . . . etc." She said that she felt dead; that her nose and lips were falling off. She was confused and showed clouding of consciousness. She looked critically ill. Her psychotic condition had developed only after she had been told her child was dead.

Her childhood was very unhappy because of maltreatment by her father. She was sensitive, introspective and obsessed with an idea that she was inferior to other girls. She was treated over some months for chlorosis. A marked improvement in her general condition occurred after she met her husband, and particularly after she left home. Immediately after her marriage her husband was called up, but she was not unduly perturbed by this.

She was discharged free of symptoms three months after admission and has remained well ever since.

CASE 5.—*Melancholic stupor occurring in a 34-year-old primipara resulting in recovery after six months. Unhappy married life. Pregnancy had resulted from extra-marital intercourse.*

Immediately after delivery she had made a suicidal attempt by hanging and she was suspected of infanticidal tendencies though no attempt was made. The stupor persisted for two months and thereafter a slow recovery took place. The patient was discharged six months after delivery.

She had expressed frequently that she believed that childbirth in one of her age was dangerous. Her marital life had been very unhappy and extra-marital intercourse had resulted in this pregnancy. The husband's attitude to this was at first one of resentment, but after the child was born he became more understanding. While she was in hospital a reconciliation was accomplished, and it is noteworthy that this coincided with the beginning of her recovery.

CASE 6.—*A paranoid depressive reaction with slight confusional features in a woman aged 39, who showed a well-marked manic-depressive predisposition, with previous depressive episodes. The child was unwanted. Recovery in seven months.*

The psychosis developed three weeks after the birth of her second child. At first she was over-talkative and elated, but very soon she became suspicious, sulky, and believed that her husband had been unfaithful to her and that he had had her food poisoned. She hated the baby so much that she wanted to kill it.

Her first depressive episode had occurred at the age of 22, just before she married, and she had three more later, each lasting for a few months. She married twice. The first husband drank heavily and was unfaithful to her. There was one child from this marriage, that pregnancy and puerperium being associated with no mental symptoms. Seven years later, having divorced her first husband, she married a widower ten years older than herself, with three grown-up children. The second marriage has been happy, although there was some initial difficulty with the step-children. She doubted the advisability of a pregnancy in a woman of her years and being the step-mother of three grown-up children. During the pregnancy, too, she had been apprehensive about air-raids.

She recovered seven months after admission, having been given two courses of electric convulsion therapy.

(Recently the patient's sister was admitted with a recurrent melancholia.)

CASE 7.—*A melancholic depression with infanticidal ideas and paranoid features, centred round the alleged infidelity of her husband, occurring during the puerperium of a woman aged 36, resulting in temporary recovery in four months. She committed suicide two months later, killing two of her children at the same time. She had had four previous melancholic attacks, two of them associated with her first pregnancy.*

The psychosis developed three weeks after the delivery of her third baby. She had been anxious and sleepless during the first five months of this pregnancy, and she had persistent hyperemesis.

Her married life was very unhappy and she had considerable financial worry. The four previous depressions were all related to pregnancies; they all persisted for two to four months, but none warranted institutional treatment.

She recovered from her last depression four months after admission. Two months later, however, she made a suicidal attempt with her three children by jumping over a pier. Two of

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her children were drowned, while the patient herself had to be removed to hospital, where she died three days later from pneumonia following immersion.

CASE 8.—*A third puerperal depression in a cyclothymic personality. Paranoid features present only in this third depression, which resulted in temporary recovery after four months, but later developed into a chronic paranoid reaction.*

This psychosis developed three days after the birth of her fifth child. She had paranoid ideas, with her husband, whom she thought to be unfaithful to her, as the main persecutor. She told of her depressed and hopeless views regarding the future, saying that she was unfit to look after the child and that she was beyond all redemption. She refused food, declaring that her husband had had it poisoned.

She made a good recovery in four months, but later developed a typical paranoid delusional system necessitating readmission to a mental hospital.

The three previous puerperal illnesses from which this patient had already suffered were all of depressive type with suicidal tendencies and feelings of inadequacy and unworthiness, but never before had there been any evidence of a paranoid tendency.

CASE 9.—*Depressive paranoid psychosis with suicidal and infanticidal ideas occurring in a woman aged* 31, *developing into a chronic paranoid reaction. Three previous stillbirths, each of which was followed by a mild melancholic reaction.*

Three days after delivery she became very depressed, expressing paranoid ideas about her husband, particularly on the grounds of his alleged infidelity. She believed that she was the victim of a systematic plot, that her thoughts were being read, her food poisoned and her body altered. She expressed suicidal ideas and harboured infanticidal tendencies.

Prior to her illness she had always been over-sensitive, suspicious and "difficult." Her obstetric history was complicated. Her first and second children had been born prematurely at the sixth and seventh months respectively, both stillborn, while the third child was also a stillborn baby though full-time. (No evidence of syphilis.) After each of these births she had had a short period of depression during which she expressed ideas of hopelessness and futility, but in none of these conditions did she require hospital care, and there was no report of suicidal tendencies.

In the course of the next few weeks the depression became less marked, but the paranoid trends became more and more fixed and systematized, until the picture became that of a chronic paranoid state.

CASE 10.—*Delirious reaction in a woman aged* 35, *during a septic puerperium. The child was unwanted. The patient's father had been a chronic epileptic.*

On the sixth day of her third puerperium she developed acute uterine sepsis. She became depressed at that time, but very soon the depression was masked by confusion, disorientation and acute hallucinosis, both auditory and visual in type. Her temperature was of a septic character, at times reaching 104° F., and her lochia were septic and odorous. She was resistive and had to be tube-fed. She was treated with urinary antiseptics and uterine stimulants. Within two weeks of admission her temperature had returned to normal, and thereafter her mental condition improved rapidly and she was discharged one month after her admission.

Her family history was negative as regards mental and nervous illness, except for the father, who was an epileptic. Her previous personality was normal and she had had no previous breakdown.

CASE 11.—*A delirious reaction with paranoid ideas occurring in a* 30*-year-old primipara. Recovery in one year. Bigamous marriage.*

The domestic situation had been satisfactory until she learned, in the sixth month of her pregnancy, that her husband had married her without obtaining a divorce from his first wife. When this became known to her she became sleepless and brooding, but it was not until twelve days after delivery that her behaviour became psychotic. She developed an acute delirium with complete disorientation, she said that her food was poisoned and that her husband was unfaithful to her, and she was suspicious about those looking after the baby. She made a good recovery and was discharged after one year in hospital. As far as is known, no further breakdowns have occurred.

CASE 12.—*A stuporose condition occurring in a* 20*-year-old primipara after a twin delivery, one twin being dead. The puerperium was septic. Her husband, who was on active service abroad, was believed to have been killed.*

Mastitis developed in the second week of the puerperium. She became very depressed, felt her body stiff, would not speak, would not feed herself and would not pass urine. Her condition became progressively worse until she became quite stuporose.

Her married life had been happy until her husband had been called up for military service. Later he was posted abroad and several months elapsed without bringing any news of him. This had worried her very considerably, as she believed that he had been killed. A week before admission a letter arrived from him and this marked the beginning of an improvement in her condition. This improvement, however, was only temporary, and she relapsed very quickly into her former stuporose condition. She has had a course of electric convulsion therapy, without much effect.

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CASE 13.—*A delirious reaction with melancholic content of thought occurring in a woman aged 28, after the death of her first child two weeks after delivery. Her mother had had recurrent attacks of melancholia, the first attack having developed during the first puerperium. Two sisters were manic-depressive psychotics.*

The psychosis developed seventeen days after the delivery of her first child and three days after its sudden death. She became depressed and agitated, expressing suicidal ideas, and demanding to be released from a life of which she was quite unworthy. She was sleepless and would not eat any food, maintaining that she could not take that of which others were in need.

Her mother had had three depressive illnesses, grave enough to demand care in a mental hospital. The first had occurred at the age of 21 during her first puerperium and persisted for four months. The second developed fourteen months later, after her second child had been seriously ill. A suicidal attempt at the age of 51 began the third depression, with which she remained in a mental hospital until her death eight years later.

The patient's eldest sister had an acute depression, lasting for two months just prior to her marriage. The only other sister has had four depressive illnesses requiring treatment in a mental hospital.

The patient herself had been well-exteriorized and tended towards the hypomanic type. At first she had been pleased about the pregnancy, but when she learned that the birth of her eldest sister had been the precipitating factor of her mother's first depression, her attitude changed and she expressed definite fears of childbirth.

The depression responded well to psychotherapy and she made a good recovery in three months.

CASE 14.—*A delirious reaction with melancholic and catatonic features occurring in a woman aged 21. Recovery in seven months. Old-standing paralysis of diphtheritic origin. One stillbirth and one miscarriage prior to this present delivery.*

The symptoms of the psychosis had been noted first five weeks after delivery, when her behaviour had become acutely disordered—she was over-talkative, elated, rambling. She acted peculiarly, said strange things and was obviously very confused. Two days later she became dull, depressed and retarded. She was fed with difficulty and slept little. Three months later she was given a course of cardiazol injections, resulting in a striking improvement in her condition. She continued to improve and was discharged seven months after admission. She has remained well since then.

At the age of 8 she had a severe attack of diphtheria followed by paralysis of the right arm and leg, and she is still severely crippled. She has always been neurotically over-sensitive about this deformity. She married at the age of 19 and her domestic life has been happy. Her husband is serving in the Army. Neither the stillbirth nor the miscarriage which preceded this pregnancy produced any marked reaction and she had expressed no fears regarding this delivery.

CASE 15.—*A delirious reaction with features of acute mania in a primipara aged 26, after the delivery of twins, followed by puerperal toxaemia. No predisposing factors. Complete recovery in three months.*

Ten days after delivery she became confused and lost all interest in the babies. A week later she became acutely excited, talking incessantly. On admission a few days later she presented the picture of an acute delirious mania with flights of ideas, restlessness and hallucinosis. Her physical condition was extremely poor and gave rise to considerable anxiety. She scratched her breast incessantly and later developed a traumatic breast abscess. She ran an intermittent pyrexia and had a progressive microcytic anaemia, the haemoglobin dropping from 76 per cent. to 52 per cent. during the first twelve days following her admission.

After a course of somnifaine she began to improve two weeks after admission. Her physical condition, too, improved, and the blood picture returned to normal after treatment with vitamins (yeast, nicotinic and ascorbic acids and adexolin) and iron. About two months after admission the mental condition had returned to normal.

Her married life was happy and she had always been healthy and well-balanced. The family history is completely negative with regard to mental and nervous illness. Her husband is a well-balanced man with a temperament very much akin to hers. There was no worry about the pregnancy.

The patient was discharged three months after admission and has remained well ever since.

CASE 16.—*A delirious state with features of acute mania occurring in a 25-year-old unmarried primipara with signs and symptoms of puerperal sepsis. Recovery after six months. Three months later acute depression developed, and death occurred in a mental hospital six months later from tubercular meningitis. Two attacks of melancholia previous to this puerperal psychosis. Family history reveals heavy hereditary loading of manic-depressive type.*

The patient was admitted a week after the spontaneous delivery of her first child (illegitimate). On the third day she had developed acute uterine sepsis and had become very ill. It was at this time that the first symptoms of mania and delirium had manifested themselves.

She had been in a mental hospital twice before with melancholic depressions lasting for three and six months respectively. She was engaged to be married to the father of the child, but he

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deserted her when he learned that she was pregnant. She was in utter despair as a result of this and endeavoured to hide the fact that she was pregnant.

Fig. 1 shows that in her family an interesting series of mental illnesses occurred.

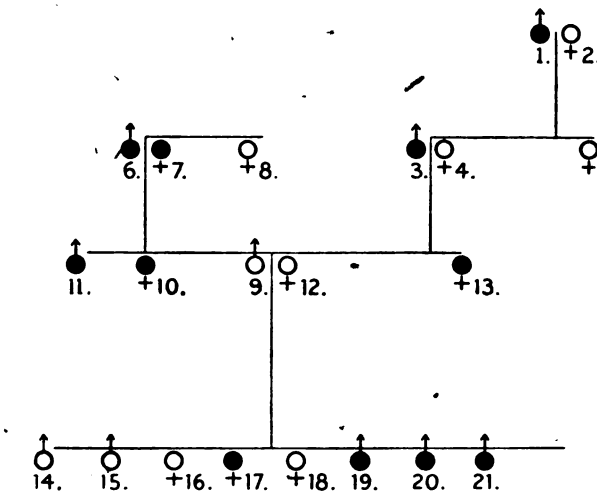

FIG. 1.

1. Maternal great grandfather: No history of mental illness.
2. *Maternal great grandmother: Died of "nerves."*
3. Maternal grandfather: No history of mental illness.
4. *Maternal grandmother: Was in a mental hospital with puerperal insanity.*
5. *Maternal grand-aunt: Died of phthisis. Neurotic.*
6. Paternal grandfather: No history of mental illness.
7. Paternal grandmother: No history of mental illness.
8. *Paternal grand-uncle: Shot himself.*
9. *Father: Neurotic. Easily excited.*
10. Paternal aunt: No history of mental illness.
11. Paternal uncle: No history of mental illness.
12. *Mother: Very dull and stupid. Had temper tantrums.*
13. Maternal aunt: No history of mental illness.
14. *Brother: Cyclothymic. Shot himself while in the Army.*
15. *Brother: In mental hospital for six months in* 1896. *Diagnosed as adolescent insanity. Escaped and remained out. Was implicated in a mutiny while serving as a naval stoker. Committed murder in* 1910 *and served a sentence of penal servitude. Always in and out of prison. Shot himself in* 1913. (According to his sister, who is at present a patient in this hospital, he appears to have been a psychopath with manic-depressive features.)
16. *Patient.*
17. Sister: No history of mental illness.
18. *Sister: Now aged* 66, *at present a patient in this hospital, where she has been for* 30 *years, with a manic-depressive psychosis.*
19. Brother: No history of mental illness.
20. Sister
21. Brother } Twins: Died in infancy.

CASE 17.—*A delirious state with hallucinosis and manic features in a* 31*-year-old woman. Recovery in* 13 *months. Her mother had had a puerperal depression and a brother committed suicide.*

The patient had been delivered of her second child six weeks before admission. The pregnancy and puerperium had been uncomplicated. On admission she was confused and hallucinated. She misidentified people. Her mood was one of ecstatic elation. She was given a course of electric convulsion therapy six months later with a remarkable improvement in her general condition. Three weeks later she relapsed into her former condition, but after a further course of four treatments she made a good recovery.

Her mother had had a period of depression for a few weeks after the birth of her first child, but the subsequent five pregnancies were normal. One of the patient's three brothers committed suicide for no known reason following an attack of influenza. The patient's previous personality was described as that of a shy, reserved, rather introspective woman with a worrying nature.

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CASE 18.—*A delirious state with manic features and symptoms of puerperal toxaemia. Death from broncho-pneumonia three weeks after childbirth. Her mother had had a depressive puerperal psychosis, and died in a mental hospital in the course of a further melancholia which developed during the year following the patient's birth.*

The pregnancy had been normal and the delivery was spontaneous. During the puerperium she developed an acute urinary infection with intermittent pyrexia. The psychosis was characterized by pressure of talk, which was frequently obscene and incoherent. Flights of ideas and emotional outbursts were well marked.

Previous to her illness she was said to have been highly strung, over-active and cheerful—a good mixer. She had worried about her husband, who was serving in the Royal Navy. Her mother had had a "puerperal" depression after the birth of her first child. She developed a further depression at the menopause and died in a mental hospital.

CASE 19.—*Catatonic stupor initiated by a delirious state in a 27-year-old primipara developing during a septic puerperium. Unhappy upbringing and family life.*

The patient had developed an acute uterine sepsis, for which she was treated by chemotherapy. A week later she became confused, disorientated and impulsive. She maintained that her husband was unfaithful to her and that he had remarried. A breast abscess developed, and while the infection was still active she was difficult to control. During the subsequent fortnight she gradually lapsed into a state of catatonic stupor with flexibilitas cerea and negativism. Her expression was dull and vacant and she did not take any interest in her surroundings. The facial muscles were pursed into a typical Schnauzkrampf. Her physical condition was satisfactory.

She is described as having had a shy, sensitive, introspective nature. She herself is an illegitimate child and has never known her father. Her mother is a difficult and unsympathetic woman. The step-father is drunken and ill-tempered and has deserted the family. Her husband is simple and lacks any understanding of the patient, maintaining that she is quite healthy. He is in the Army and has been absent from his wife during her pregnancy. Six months after their marriage she had a miscarriage, after which she was rather silent and depressed. It was said that she was looking forward to the birth of the baby.

Soon after her admission her condition improved considerably, though she remained quite mute. She received intensive vitamin therapy (yeast, nicotinic and ascorbic acids and adexolin), and later was given a course of electric convulsion therapy. She improved remarkably with this treatment, but unfortunately this had to be discontinued because of a fracture of her second lumbar vertebra. Soon after she relapsed to her former state and during the last seven months she has remained stuporose.

CASE 20.—*A catatonic state occurring in a 29-year-old primipara and developing into a chronic schizophrenic condition. Unhappy married life.*

Her behaviour had been abnormal ever since delivery. At first she was tense and apprehensive and irritable. Gradually she lapsed into a stuporose condition. On admission she could not be contacted and remained quite mute, taking no interest in anything. She was impulsive at times, these outbursts being precipitated by visual and auditory hallucinations.

There is no history of mental illness in the family. Her married life was not happy and her husband neglected her. He was called up for military service three months after the child was born and since then the patient has been more reticent and introspective. During his leaves it has been noticed that her symptoms are more marked.

The patient was given a course of nine electrical convulsions with very little improvement. She was discharged unrelieved.

CASE 21.—*A delirious state with aggressive behaviour and homicidal attacks in the puerperium of a chronic epileptic. Distressing home background. Recovery in the three months.*

The patient had been delivered two weeks previously. The delivery had been spontaneous and the pregnancy had been physiologically normal. She had not wanted this child, partly because her husband was away from home on active service, and partly because of major epileptic convulsions to which she had been subject since the age of nine. During the pregnancy, and particularly during the last three months, these fits had been more frequent. On the eighth day after delivery she become confused, and her admission to a mental hospital was made necessary because of an attack on her child by banging its head against the wall. On admission she was truculent, irritable and aggressive. Soon after she became acutely delirious. Furors were frequent and difficult to control. Occasional homicidal attacks on other patients were reported. Major epileptic convulsions occurred every second day during the first three weeks after admission. She became progressively exhausted and lost weight rapidly. There was, however, no sign of toxaemia.

Her parents were both intemperate and brought up their children indifferently. No history of epilepsy or any other mental illness was found in any member of the family.

Her marriage in 1937 has brought her much worry and anxiety, her husband being intolerant, aggressive, of alcoholic habits and a deserter from work. In 1938 he was put on a year's probation following an assault on his wife. He joined the Army in 1940, and was away from home during the last seven months of his wife's pregnancy. Their first child is aged 2, that pregnancy and puerperium having been quite normal.

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Three weeks after admission her condition began to improve. The fits became less frequent, her delirious state gradually cleared up and she was well enough to be discharged after three months. She has remained fairly well, though she still has occasional fits and temper tantrums.

COMMENT.

The following relevant facts emerge from the case-material presented:

Reaction types.—Ten cases (Nos. 10, 11, 13, 14, 15, 16, 17, 18, 19 and 21) developed shortly after childbirth an acute delirious reaction. Only in three cases (Nos. 10, 16 and 19) was the puerperium septic, while in two other cases (Nos. 15 and 18) there were features of toxaemia and extreme exhaustion, which could be related in the first case to an unusually long labour and twin birth, and in the second case to a flaring up of a chronic urinary infection. In the remaining sixteen cases the puerperium was uncomplicated. Of this case material those who had septic or other toxaemic complications developed confusional conditions of the organic reaction type; on the other hand, psychotic reactions of this same type could be observed in seven cases (Nos. 4, 11, 14, 15, 17, 18 and 21) where no puerperal complications had occurred.

Typical melancholic reactions were observed in nine cases (Nos. 1, 2, 3, 4, 5, 6, 7, 8 and 9), but in some of these there was a slight clouding of consciousness which, however, did not result in thought disorder or disorientation.

Manic features were obvious in the delirious states of three cases (Nos. 15, 16 and 18), but in general manic or depressive features were present at times in almost every psychosis whatever the predominant clinical manifestations. Some of the cases with organic reaction type could be classified as delirious mania, while in others depressive features coloured the delirium.

Stupor was observed in four cases (Nos. 5, 14, 19 and 20). In three of them the stupor was of catatonic type, and two of them (Nos. 19 and 20) developed into chronic schizophrenic states, while the third (No. 14) recovered. In Case 5 the stupor was of melancholic type.

Paranoid features were noted in five of the nine melancholic cases (Nos. 6, 7, 8, 9 and 11), the main delusional ideas being centred around the alleged infidelity of the husband. The idea that the child was being taken away from them occurred in four cases (Nos. 6, 8, 9 and 20). The ages of those paranoid cases ranged between 31 and 39 years. The delirious states of Case 21, who was a chronic epileptic, differed from the others by the fact that in this case only strong aggressive impulses were directed, not against herself or the husband or the child, but against those whom she suspected of having attempted to kill the child. This patient had a large series of fits during her psychotic period, and it can be assumed that her psychosis was largely coloured by the underlying epilepsy.

Previous psychotic illnesses.—Among the nine multiparae, three (Nos. 7, 8 and 9) had had a similar psychosis during previous puerperia. These recurrent puerperal psychoses were of the melancholic type. Case 7 had had a melancholic reaction after the first of three previous deliveries. This patient eventually killed herself and two of her children, following her second melancholic puerperal psychosis. She had also had three other melancholic attacks not associated with childbirth. Case 8 had had melancholic depressions following three of her four previous deliveries. It is of interest that the melancholic reaction following her fifth delivery showed paranoid features for the first time and later merged into a chronic paranoid condition. Case 9 had had mild depressive paranoid reactions after each of her three previous deliveries.

In Case 6 mild melancholic depressions, unrelated to childbirth, had occurred previously.

Among the twelve primiparae, two (Nos. 3 and 16) had had psychotic episodes prior to their pregnancies. In Case 3 this had taken the form of a melancholic reaction of much milder degree than that developing during the puerperium. In Case 16 previous episodes had also been of melancholic type, but the psychosis following the puerperium was of the type of a delirious mania.

Previous personality.—In Cases 10, 12 and 15 no abnormal trends were detected in the previous personality. In addition to the five patients mentioned before, with definite psychotic episodes of a manic-depressive type prior to the illness under consideration, there were five others, Nos. 5, 6, 11, 13 and 18, showing

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cyclothymic features. In three cases, Nos. 17, 19 and 20, the personality conformed to the schizoid type. In other three cases, Nos. 1, 4 and 14, there had been neurotic symptoms in the previous history mainly of the anxiety type. Case 2 showed a psychopathic personality, and Case 21 the personality of a chronic epileptic.

Heredity.—In four cases, Nos. 13, 16, 17 and 18, puerperal psychoses had occurred in the ancestry. The most instructive is Case 16, where the family history could be traced back to the fourth generation, and it was found that the manic-depressive reaction type had predominated. In that case it was obvious that the septic puerperium served merely to precipitate and colour an endogenous psychotic reaction. In Cases 13, 17 and 18, each presenting a delirious state with manic features, the mothers had had puerperal psychoses of depressive type, and in two of these, Nos. 13 and 18, the mothers later developed involutional melancholia after pregnancies in middle life. The father of Case 10 was an epileptic. Psychoses among siblings were recorded in Cases 6, 13, 16 and 17; they were all of the manic-depressive reaction type.

Environmental and sociological factors.—In all but one of the cases (No. 15) there had been gross psychological difficulties affecting the attitudes of the patients toward childbirth, and these were based on environmental and sociological factors in the widest sense. The difficulties arose either from a deep-rooted aversion to pregnancy and childbirth or from an unsatisfactory domestic situation. These case-histories show a great variety of factors which seriously aggravated the emotional stress of childbirth; illegitimacy, bigamous marriage, extra-marital conception, unhappiness of married life, religious conflicts and absence of the husband from the home constituted examples of such factors. It is of particular interest at the present time that in seven cases the absence of the husband on military service had resulted not only in a breaking up of the domestic life during pregnancy, but also in severe emotional tension. Stillbirth or death of the child soon after delivery acted as yet another contributory factor. In two cases a marked neurotic reaction on the part of the husband towards pregnancy added to the psychological difficulties of the patients.

Therapy.—In five cases, Nos. 1, 3, 6, 19 and 20, electric convulsion therapy was applied. In two cases it had to be discontinued early owing to the occurrence of a fracture, which in Case 3 was not directly associated with treatment, though in Case 19 a fracture of a vertebra occurred during a convulsion. In the three cases where treatment could be carried out in full, recovery followed either during or soon after the course of convulsions. In Case 14 a short course of cardiazol was administered and it seemed to expedite recovery. It is noteworthy that in at least two of the five cases treated with electric therapy, the menstrual cycle was re-established very early in the puerperium during or immediately after the course of treatment. In all the recent cases intensive vitamin therapy (yeast, ascorbic and nicotinic acids and adexolin) was used, and this seemed to have a beneficial effect on the general condition of the patient. In two cases with septic complications, Nos. 12 and 19, sulphonamide was given immediately pyrexia developed and was continued until the sepsis abated.

Statistics.—Although this case-material is sufficient to demonstrate the reaction types occurring in psychoses following childbirth and the various aetiological factors, it is, of course, too small for statistical purposes, and its evaluation along such lines would be misleading. Therefore a further series of 131 cases was surveyed, making 152 in all.

In recording the relative proportions of the various psychotic reactions, it had to be taken into consideration that there is a certain amount of overlapping between the various reaction types. In many cases it is difficult to establish a definite diagnosis retrospectively, and a follow-up of the post-psychotic developments of the patients could not be carried out in all cases. Those difficulties manifested themselves in many cases, where the psychotic condition during hospital treatment permitted of a provisional diagnosis only. It was decided therefore to group cases exhibiting features of the organic type, such as delirium, together with those demonstrating not only those features, but also catatonic symptoms. Clinical observation shows that catatonic features are frequently associated with delirium, and that their occurrence does not necessarily influence the diagnosis or prognosis of such cases. Many of the cases were lost sight of, and it is felt that without a

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thorough psychiatric follow-up, the differential diagnosis of those conditions could not be quite accurately determined. (The great differences between the statistics of various authors on that subject are clearly due to the fact that some writers attempted to establish diagnoses in a case material which had not been under their personal observation at the time of the illness.) With this limitation in mind the following statements can be made:

		No.	Per cent.
Manic-depressive reaction types	Typical melancholic depression	46	30
	Melancholic stupor	5	..
	Melancholia with paranoid features	27	18
	Melancholia with paranoid features developing into chronic paranoid reaction	3	..
	Manic reactions	20	13
	Total percentage of manic-depressive reaction types	..	52
Reaction types with delirium and catatonic features		46	30
Chronic schizophrenia without remissions		5	..
General paralysis		1	..
Epileptic psychosis		2	..

Recurrent puerperal psychoses were of the following types:

Recurrent puerperal melancholic reaction	8	..
,, ,, manic reaction	8	..
,, reactions with delirium and catatonic features	4	..

	No.	Per cent.
Civil state of patients:		
Married	140	92
Single	12	8
Reaction types among those with illegitimate childbirths:		
Melancholic	3	..
Manic	4	..
Chronic paranoia	1	..
Organic reaction type	4	..
Cases with a septic puerperium	25	17
Married	18	..
Single	7	..
Reaction types among patients with septic puerperia:		
Melancholic reaction	7	28
Manic reaction	4	16
Organic reaction types	14	56
Suicidal and infanticidal attempts:		
Successful suicidal attempts	8	..
Infanticidal attempts	20	..
Successful infanticidal attempts	4	..
Stillbirths:		
Total number of stillborn babies	9	..
Stillbirths with septic puerperia	2	..
Reaction types following stillbirths:		
Melancholic reaction	7	..
Delirious reaction (both cases septic)	2	..

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Average age of patients :

Total average age	25 years.
Average age of patients with paranoid features	34½ ,,

Parity :

	No.
Average parity of all cases	2
,, ,, of melancholic reactions	2·5
,, ,, of melancholic reactions with paranoid features	3·5
,, ,, of manic reactions	1·5
,, ,, of delirious reaction types	2
,, ,, of schizophrenic reactions	1

Duration of psychosis :

Melancholic reaction	7 months.
Melancholia with paranoid features	11 ,,
Manic reaction	8 ,,
Delirious reaction type	5 ,,

Duration of recurrent psychoses, including episodes unconnected with childbirth :

Melancholic reaction	9 months.
Melancholia with paranoid features (excluding three cases which developed into chronic paranoid reactions)	18 ,,
Manic reaction	12 ,,
Delirious reaction type	8 ,,

Number of days between the delivery and outbreak of psychosis :

Melancholic reaction	10 days.
Manic reaction	4 ,,
Schizophrenic reaction	30 ,,
Delirious reaction	5 ,,

Discussion.

The case material presented proves that every reaction type may occur during the puerperium. A puerperal psychosis as a clinical entity does not exist. Not even one-third of the material surveyed showed delirious and catatonic features, which would be expected if toxic or exhaustive factors played an important part in precipitating those psychoses. By far the largest group was represented by cases of the manic-depressive type. In a number of those cases, however, the features of the organic-reaction type were also present, especially a certain degree of distressed perplexity (Hoch and Kirby). This has been noted by Strecker and Ebaugh, who found that the manic-depressive conditions following childbirth tended to differ slightly from the typical psychoses of that group. The slight "organic colouring" of the depressive psychoses is to be expected in the puerperium. Clinical observation shows that the same "colouring" sometimes occurs when an organic illness develops in the course of an existing psychosis. The complicated interaction of the organic and constitutional factors can be seen in those cases where a recurrent manic-depressive reaction was obscured by a superimposed organic reaction type due to a septic puerperium. Overlapping occurs not only between the manic-depressive and delirious reaction types, but also between the manic-depressive and paranoid reactions, as shown by the fact that in some cases a melancholic condition developed into a chronic paranoia. Further, from a selection of schizophrenic reactions during the puerperium reported by Zilboorg it can be seen that depressive features were present in each of his cases.

Sepsis in the puerperium increased the incidence of delirious states, but it cannot be said that this reaction type was specific for psychoses developing during a septic puerperium. Nearly half of the psychoses associated with sepsis were not of the delirious type but of the manic-depressive type. The higher incidence of sepsis among illegitimate mothers is understandable, in view of the less favourable environmental conditions and the greater emotional strain. It must be understood,

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however, that a septic puerperium in itself is relatively unimportant as a factor precipitating psychotic reactions unless it is complicated by the presence of other predisposing and precipitating factors. As an illustration of this point, it is of interest to note how small is the incidence of psychoses among women with puerperal sepsis—a report by Watson on an epidemic of puerperal sepsis observed in 1928 in a New York Maternity Hospital quotes, out of 25 cases, only one with psychotic manifestations, and this case was diagnosed as a manic reaction. The recovery-rate of the psychoses following childbirth is certainly high. As in this material a follow-up was possible only in a small proportion of the total cases a calculation of the recovery-rate was not carried out. Of the 21 cases reported in detail, 4 are still under treatment, 2 being very recent admissions, 2 developed chronic psychotic reactions, 1 committed suicide, while the others recovered. This material conforms to the opinion generally held that the prognosis of psychoses following childbirth is very favourable. This is to be expected in a case-material involving a high proportion of manic-depressive psychoses.

The hereditary factor was of importance mainly among the manic-depressive group. It is noteworthy that especially in that group there was a tendency towards recurrence of psychotic reactions after subsequent deliveries; but it seems that the association of childbirth with a psychotic reaction was more likely to occur when other precipitating factors of either physical or psychogenic origin co-existed. This can be seen in patients who, though they were predisposed, developed a psychosis only after a childbirth where such precipitating factors existed, while no psychosis had followed previous childbirth uncomplicated by such aggravating conditions. There is no doubt about the fact that in manic depressives the likelihood of a psychosis following childbirth is considerably greater than in other personality types. The outstanding prevalence of the manic-depressive reactions over the schizophrenics is, of course, partly due to the fact that the marriage rate and parity of schizophrenics is lower. The low marriage rate among schizophrenics can be proved statistically (Stalker).

The statistical findings recorded in this article are on the whole in agreement with more recent writers, who stress the incidence of affective reaction types. The high proportion of manic-depressive reactions cannot therefore be ascribed to a higher incidence of these reactions in the local population from which the series of cases described in this paper was selected. Their incidence far exceeds the relative occurrence of the same reaction type in a similar age group among cases not associated with childbirth, as judged from a superficial study of the total admissions to this hospital. The considerable diversity of the proportions of cases allocated to the organic reaction types and to schizophrenia is due to differences in diagnostic approach which have been referred to before.

This case-material proves beyond doubt the importance of the psychological factors arising from environmental influences. It can be said that any condition which gives rise to a conflict about childbirth resulting in an increase of mental stress may operate as a precipitating factor, and may, provided that other predisposing conditions exist, result in a psychotic reaction. The psychological difficulties were readily detected, as the patients were in most cases conscious of them. In the majority there was an aversion towards childbirth in general or towards the particular childbirth under consideration. In some there was no negative attitude towards the child, but there was a neurotic attitude towards motherhood based on experiences in the parental home. In a number of cases the emotional difficulties centred around childbirth were based on an unsatisfactory married life. Henderson and Gillespie have reported an instructive case of involutional melancholia following childbirth in which that factor, together with hereditary loading of the manic-depressive type, appeared to play an important part.

In a further group of cases it was obvious that the absence of the husband during pregnancy and childbirth had been responsible for precipitating a serious emotional crisis associated with childbirth. In two cases neurotic behaviour of the husband towards pregnancy had obviously exaggerated the tendency to abnormal emotional reactions on the part of the woman. Little attention has been paid by psychiatrists to this problem. The rite of the Couvade is an example of the manner in which, under primitive conditions, the husband takes part in the psychological events associated with childbirth. (In this rite the husband identifies himself with his wife in the puerperium.) E. Jones has recently pointed out that

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the attitude of the husband is often responsible for the occurrence of psychogenic complications during labour, and he draws attention to the important practical implication of this finding. The hyperemesis of the husband of Case 1 suggests a similar mechanism of identification.

The delusions occurring in a proportion of cases expressed hostility for husband or child, thus reflecting the conflict about married life and motherhood. It is noteworthy that the main delusional ideas centred round an alleged infidelity of the husband. These delusions were found especially in women in the fourth decade of life—an age when feelings of inferiority, so frequently associated with the menopause, tend to make their first appearance. It is understandable that childbirth was particularly apt to give rise to such ideas. Nihilistic ideas occurred on the same psychological background. Those delusions fall into the category of katathymic ideas.

The frequency of infanticidal tendencies reflects the hostile attitude towards the child. It can be assumed that a deeper psychological investigation than that employed in this case-material would reveal many mechanisms which do not readily appear on a conscious level; but the conflicts were so obvious in those cases that their existence could be proved by careful psychiatric investigation alone. Zilboorg found in all the cases of schizophrenia following childbirth a history of old-standing sexual difficulties, and he is inclined to attribute great importance to this factor in puerperal psychoses. It may be assumed that an investigation into this problem would have indicated similar conditions in many cases, but it was not attempted to enter into those investigations, as the information on that subject as given by patients in a psychotic condition must always be of very limited value. The specificity of Zilboorg's findings is open to doubts, as sexual difficulties are found in the histories of a great majority of schizophrenics whether or not the outbreak of the psychoses is associated with childbirth.

The experiences with recent therapeutic measures employed in those cases are much too limited to permit of any definite conclusions being drawn. It seems, however, that psychoses following childbirth constitute a field for convulsive therapy, and the observations in this material suggest that such treatment might expedite recovery.*

Though a careful consideration of physical contra-indications is essential, it is not thought that convulsion therapy need be delayed until the end of the physiological puerperium. The fact that the literature contains no reference to idiopathic epileptic fits in the early puerperium having been followed by complications arising from the state of the uterus, suggests that no undue risk may be associated with convulsion therapy in those cases. It would seem advisable, however, not to apply this therapy within a month after delivery. In non-puerperal cases it has been noticed that during shock therapy menstrual irregularities tend to become less marked and cases of persistent amenorrhoea have reverted to a normal menstrual cycle. In other cases menstruation tended to become for some time very profuse. It seems not unlikely that shock therapy, acting probably via the vegetative nervous system, has some stimulating influence on hormonal control. The problem arises as to whether there was any relationship between the early return of menstruation and the recovery from the psychotic state.

Further observations would be necessary to assess the value of vitamin therapy, which in some cases seemed to produce a remarkable improvement in the general condition, especially when there were signs of exhaustion. It is noteworthy that in this connection the experiences with vitamin therapy in pre-eclamptics treated by Prof. Johnstone at the Maternity Hospital of the Royal Infirmary, Edinburgh, have been very encouraging.

It is noteworthy that Neuburger has reported good recovery in three cases of melancholic depression after childbirth treated with anterior pituitary hormone. Treatment with oestrogenic hormones has been tried without impressive results; but treatment with pituitary hormones deserves interest in view of the fact that definite changes occur in the pituitary during pregnancy.

It does not seem that modern chemotherapy in puerperal sepsis has materially reduced the incidence of psychotic reactions. This is not surprising in view of the

* Tod and Daly have observed satisfactory results in this hospital with electric convulsion treatment in ten cases of psychotic reactions in the puerperium.

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fact that septicaemia is only one of the extrinsic factors contributing to the origination of psychoses. Further investigations will have to show whether this therapy has any influence on the reaction type and on the course of the mental illness.

The findings regarding the aetiological factors of psychoses following childbirth are of considerable interest with regard to preventive medicine. It has been shown that heredity together with environmental factors in the widest sense act as predisposing and precipitating factors. There are cases in which a closer consideration of all those factors involved will make termination of pregnancy not only justifiable but imperative in the interest of the patient's mental health, disregarding eugenic considerations, for which the law makes no provisions. That solution applies especially to those cases showing recurrent psychoses. The prognosis, as Harris has pointed out, and as was indicated in this material, deteriorates with every successive psychosis. At the same time the constellation of each individual pregnancy has to be regarded in its own merit. It has been shown in this study that predisposition and even previous psychotic episodes do not permit of the conclusion that a pregnancy itself will necessarily result in a psychosis. In some cases a psychosis did not appear if the environmental circumstances relating to that pregnancy were favourable. In general, women who have been subject to psychotic episodes during previous puerperia should be discouraged from embarking on further pregnancies, and in some cases sterilization may be advisable.

The great pathogenicity of environmental factors as borne out by this investigation points to the existence of an important field of preventive psychiatric treatment which has as yet not received due attention, though various writers (Strecker and Ebaugh, Piker and Howard) have indicated its importance. Along with antenatal care and treatment there should be a constant survey of the psychological condition of the pregnant woman, and if necessary intensive psychological treatment should be carried out. Such treatment would have to be directed towards establishing a healthy attitude towards childbirth, the developing of a sound maternal instinct, and the removal of acute conflicts arising from the marital situation. It may often be necessary for the psychotherapist to extend his interest to the husband or to others with whom the woman is living.* By thus depriving environmental conditions of their pathogenicity the proportion of psychotic reactions could well be materially reduced.

Summary.

Twenty-one cases of psychotic reactions following childbirth have been studied and a further case-material of 131 cases has been surveyed. In accordance with recent authors' findings, it has been proved that " puerperal insanity " as a clinical entity does not exist, and that every reaction type defined in clinical psychiatry may occur in the puerperium. Various factors contributing to the origin of psychotic reactions following childbirth have been isolated: hereditary loading, predisposing personality trends, environmental and sociological conditions, psychological experiences arising from childbirth, and physical complications of the puerperium. It could be demonstrated that the latter factor, which in the past has been regarded as the most important, plays only a minor role, and operates as a precipitating agent only in co-operation with other intrinsic and extrinsic factors. In more than half of the case-material the reaction type was typical of one of the affective psychoses, and in this group the constitutional make-up, as illustrated by heredity and pre-psychotic personality features, was found to be particularly important, though even here it did not operate without additional precipitating conditions. In a proportion of the affective psychotic reaction the clinical picture was coloured by features of the organic reaction type. In a considerable proportion of the melancholic reactions paranoid features were prominent, the delusional ideas being of the katathymic type, connected with the psychological implications of childbirth. Such paranoid features were found not before the fourth decade, and in some cases the melancholic reaction merged into a chronic paranoid condition. The comparatively small number of typically schizophrenic reactions can be partly attributed to the low marriage rate and parity of schizophrenics and schizoid personalities. The wide variety of psychogenic factors based on environmental and sociological conditions has been demonstrated and analysed. Certain mechanisms

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which have received little attention hitherto have been pointed out. The administration of convulsion therapy has been advocated, and encouraging results from intensive vitamin treatment have been reported. A plea for preventive measures, including psychotherapy in the ante-natal period, has been made.

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THE MAINTENANCE TREATMENT OF CHRONIC PSYCHOTICS BY ELECTRICALLY INDUCED CONVULSIONS.

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IN the early days of convulsion therapy many chronic psychotics were treated by this method in the hope of effecting a cure. While temporary improvement was achieved in most cases, results were disappointing, owing to the rapidity with which relapses occurred. With cardiazol as the convulsant, various complications, such as sclerosis of veins, tachycardia, vomiting and, most of all, aversion to the treatment on the part of the patient made its continued repetition impracticable.

The introduction of electrical convulsion therapy with its ease of administration and relative freedom from complications suggested the idea that some patients might be treated at intervals over an indefinite period—what is called "maintenance treatment."

Col. McCowan suggested that this method might be applied systematically to chronic psychotics, not with the idea of completely curing them, but in order to keep them at a higher level of behaviour and mentation. With this object in view a trial was made in a group of cases, and since the treatment has now been in use for more than two years it seems appropriate to review the results.

MATERIAL.

There are at present 62 patients on maintenance treatment out of a population of 1,250 in Crichton Royal. Fifty-six cases are reported here, including 11 who are regarded as failures. These include 37 schizophrenics, whose average duration of illness is nine years and whose ages range from 18 to 72, the average being 43; 8 are involutional or senile melancholics who have been ill on an average for four years and whose ages range from 46 to 71, averaging 60. Besides these, 6 manic-depressives, 3 periodic catatonics and 2 hyperkinetic mental defectives who have been treated are included to illustrate special points.

The criteria for selection of cases were that the patients' behaviour endangered their own health, e.g. by refusal of food, constituted a serious nursing problem, e.g. by being wet, dirty or destructive, or that their mental state was one of acute misery, as in agitated melancholia.

Chronic patients who had become adjusted to hospital life and followed the ordinary routine contentedly or apathetically were not chosen after some attempts had shown that in these cases improvement is negligible and does not justify the rigorous procedures involved in the treatment.

TECHNIQUE.

The electrically induced convulsions were given with the apparatus described by Fleming, Golla and Grey Walter (1)—a modification of Cerletti and Bini's (2) original. Timing of treatment varied with the individual case. An initial course of six to nine fits was given within two to three weeks, followed by maintenance treatment as required.

As a rule treatment was recommenced at the first sign of relapse. This was relatively easy when relapse was heralded by acute symptoms. In cases which

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went back insidiously much depended on the constant watch of the nursing staff for early signs of deterioration. Trial must be made until the optimum spacing has been found. The maximum number of monthly fits found necessary was four in regular cases, e.g. Cases 3 and 4. If the interval was longer than one month a series of six fits was sometimes necessary. Usually the fits were given in groups at two or three-day intervals, though in some cases a weekly fit was most beneficial —occasionally necessitating five fits a month.

The majority of patients did not object to the treatment and came for it willingly. In some cases forceful persuasion was necessary, but often this could be avoided if treatment was given before the patient had relapsed too far. Some patients, especially the elderly ones, were difficult to convulse, even with what is regarded as the safe maximum strength and duration of current. No improvement followed these subconvulsive doses. Similarly a few cases given intentional subconvulsive doses did not improve, though they did so later when a complete fit was induced.

In the fit-resistant cases it was found helpful to give 10 to 20 units of insulin one hour beforehand, the rationale being that the outpouring of gastric juice which follows the injection deprives the blood of some of its NaCl and induces a slight alkalosis. This method was found more successful than the administration of large doses of potassium citrate up to 6 gm., which was also tried.

This group of cases included many elderly people and some in very poor physical health through exhaustion from agitation, refusal of food, insomnia, or the prolonged administration of drugs previously necessary. Yet no fracture or other complication occurred. In fact it seems clear that these patients are less liable to fractures than the young athletic type, whose stronger muscular contractions make the accident more likely. The question of intellectual deterioration and memory change will be discussed later.

Results.

Group of Chronic Schizophrenics.

Every large mental hospital has patients of this group who seem resistant to all efforts to help them to adapt to hospital life despite careful nursing and all facilities in the way of occupation, recreation and hydrotherapy and the skilful use of sedative drugs.

Of 37 of these cases given maintenance treatment improvement was achieved and is still maintained in 26. In 11 there was either no improvement, or it was so fleeting that it was not considered worth while going on, and they are reported as failures.

In almost all the successful cases there was no question about the value of continuing the treatment, but Case 24 is an example of a type where this is debatable. Before treatment the patient was dull, apathetic, idle and occasionally faulty in habits. Following treatment she became a little brighter; she did some teasing of cloth in a mechanical fashion and her faulty habits were controlled. She was not a failure, but improvement was minimal. This type, which barely fulfils the criteria for selection, was found to be least favourable. In general the more florid the symptoms the more likelihood there is of improvement being marked.

It is difficult to find a common factor to explain the failures. In some cases the principal symptoms were those not much influenced by maintenance treatment in any of the patients, e.g. impulsive destructiveness. A more important point is that in most of these patients the illness started at an earlier age, affecting a personality not so resistant and consolidated as those who reached a later age before breaking down.

This bears out the well-known clinical experience that the personality is much better preserved in schizophrenia making its appearance after thirty.

Details of the cases in this group are collected in Tables I and II.

The following are representative cases in greater detail, illustrating two types which responded very favourably. The first is illustrative of a group of paranoid schizophrenics in whom the personality has not disintegrated (Cases 17, 18, 19, 20 and 35).

The second typifies a breakdown in middle life with acute schizophrenic symptoms and regression to a low level occurring in individuals of originally good personality (Cases 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10).

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CASE 17.—Male, aged 33. Admitted 5.iii.1940.

He was a sensible, intelligent, rather shy and solitary man, who liked his work as a miner. He was good natured and fond of his family, but found social adaptation difficult. For two years before admission his family noticed a change; he became irritable, suspicious, self-absorbed and more markedly asocial. For the last six months of this period he refused to work, had ideas of reference and expressed delusions of a persecutory and grandiose nature. He thought he had found the secret of "perpetual motion" and for this reason was being spied on, and that attempts were made to poison him and to harm his body with electricity. He imagined people were listening to his thoughts and that everyone was against him. He had angry outbursts and was violent at times. He sat about the house or lay in bed all day.

On admission he was given a course of insulin treatment consisting of 48 treatment days with 27 comas. He improved enormously, became cheerful, co-operative, and industrious, and his delusions and hallucinations disappeared.

Discharged 20.v.1940 and returned to his work.

Readmitted 2.ix.1940. He presented a similar picture to that on original admission. He was given a second course of insulin—this time 63 comas. He again improved, but after some months relapsed. He was put on maintenance treatment just over a year ago. Since then he has had 25 fits at intervals as shown in Table I, and these have kept him almost constantly at a good level of behaviour. He is pleasant and co-operative, helps with the work in the ward, accompanies the driver of a hospital lorry on his journeys and helps him to load and unload. He enjoys full parole, eats and sleeps well. At intervals which vary from a few weeks to a few months he becomes moody, irritable, complains that the doctors are experimenting on his body, that his food and cigarettes are being poisoned and he begins drawing plans for his "perpetual motion machine." He stops work, sleeps badly, becomes aggressive and may have violent outbursts if disturbed. These changes are the indication for further treatment, which at once brings about a dramatic improvement.

CASE 3.—Female, aged 54.

Developed normally. Average intelligence, quiet and reserved. Fond of company, but too shy to make good social contact. Lived at home and took an active part in church work and girl guides. Ten years ago, following the death of her mother, she became apathetic, self-centred and hypochondriacal, she lacked concentration and slept badly. Her self-absorption increased, she developed delusions and became auditorily hallucinated.

Admitted to the Crichton Royal 13.i.34. She gradually lost all contact with reality and regressed to a low level. In 1939 she had twelve cardiazol fits and improved for a short time. Because she was terrified of the treatment, it could not be continued.

Maintenance electrical convulsion therapy was commenced on 24.ix.41. At this time she was constantly in bed, noisy, restless, shouting and screaming for long periods both day and night. She had to be spoon-fed, but frequently made herself vomit after meals and became extremely emaciated. She was wet and dirty, and made no attempt to keep herself clean and tidy. Vivid auditory hallucinations kept her in a constant state of unrest. She had many fantastic delusions, e.g. that her father was in a cellar below the ward and that the staff were torturing him by pouring boiling water over him. If allowed she would jump out of bed and make vicious attacks on old or helpless patients. Except for the short improvement after cardiazol, she had been in this state for over seven years. There was a marked improvement after the initial course of six fits. Three fits monthly have maintained this level of behaviour. She is quiet, co-operative, takes her food well and sleeps all night without sedative. She has gained 37 lb. in weight. She is now clean in habits, tidy, takes an interest in her surroundings, does handiwork in the occupational therapy department, reads novels and newspapers.

On close questioning, both these cases reveal that they are lacking in insight and delusions and occasional hallucinations are still present, but the important point is that for an appreciable time after each treatment these symptoms are largely disregarded and have no influence on their overt behaviour.

Group of Involutional and Senile Melancholics.

There is general agreement that this type of case responds very well to convulsion therapy, and treatment is given in the hope of effecting a cure. A proportion of them repeatedly relapse, however, and in these cases maintenance treatment has been used. Results are collected in Table III. In general they correspond closely to those obtained in the schizophrenic group—the symptoms most influenced, in addition to the depression, being insomnia, faulty habits and refusal of food.

Group of Chronic Manic-Depressives.

Every mental hospital provides examples of patients who have been in and out of hospital for years and become permanently institutionalized in the end, although they may be relatively well for long periods.

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TABLE I.—*Group of Chronic Schizophrenics.*

Number.	Name.	Sex.	Age.	Duration of illness.	Number of monthly treatments.	Clinical picture. Before.	Clinical picture. After.
1	Har—	F.	55	10 years	8, 1, 2, 1, 2, 1, 2, 2, 2, 4, 0, 4, 0, 0, 4, 0, 4, 0, 0, 4, 0, 6, 0, 0	Noisy, hallucinated, impulsive, unco-operative, aggressive, insomnia, spoon-fed	Quiet, helpful, works at occupational therapy, eats, sleeps, dances.
2	Wih—	F.	58	8 „	10, 0, 2, 2, 2, 0, 4, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0, 3, 0, 0, 0, 0, 0	Noisy, agitated, destructive, untidy, wet and dirty, idle, insomnia, spoon-fed	Quiet, co-operative, works at occupational therapy, clean, tidy, sleeps, eats.
3	Rog—	F.	54	10 „	6, 3, 3, 3, 3, 3, 3, 3, 3, 2, 3, 3, 3, 3	Noisy, hallucinated, in bed, untidy, wet and dirty, idle, spoon-fed	Quiet, co-operative, works at occupational therapy, reads, clean, tidy, eats.
4	Bru—	F.	72	12 „	7, 5, 4, 3, 4, 3, 2, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 2, 3, 3, 3, 3, 3, 3	Stuporose, mute, idle, resistant, spoon-fed, wet and dirty	Eats, speaks, works at occupational therapy, reads.
5	Wat—	F.	62	16 „	3, 5, 1, 2, 0, 0, 0, 0, 0, 0, 5, 0, 0, 0, 3, 0, 0, 0, 0, 0, 0, 3, 0, 2, 4, 0, 0	Delusions, hallucinated, idle, dirty, degraded, masturbated, shameless, aggressive	Clean, better behaved, manageable, still hallucinated and delusional.
6	Gib—	F.	51	7 „	3, 7, 5, 3, 2, 4, 3, 4, 2, 5, 2, 3, 3, 2, 4, 3, 3, 0, 3, 3, 3, 3, 3, 1, 3, 3, 3	Suicidal, spoon or tube-fed, wet and dirty, degraded, at times aggressive, insomnia	Clean, tidy, eats and sleeps, works at occupational therapy, reads, plays bridge.
7	Gum—	F.	58	10 „	4, 4, 1, 5, 5, 4, 3, 3, 3, 3, 3, 2, 4, 3, 0, 0, 3, 3, 3, 0, 0, 0	Noisy, destructive, tube or spoon-fed, stuporose at times	Quieter, tidy, co-operative, eats, works in ward, garden and occupational therapy.
8	Bla—	F.	67	8 „	3, 0, 0, 0, 0, 2, 5, 0, 0, 0, 0, 0, 0, 3, 0, 0, 0, 0, 0, 0, 5, 0, 0, 3, 0	Untidy, wet and dirty, hallucinated, delusional, spoon-fed, insomnia, interfering	Clean, friendly, eats, sleeps, manageable.
9	Mil—	F.	58	15 „	1, 6, 1, 2, 2, 0, 0, 0, 0, 0, 0, 3, 0, 0, 0, 3	Wet and dirty, hallucinated, impulsive, noisy, insomnia, withdrawn	Clean, quieter, co-operative, talks rationally, works at occupational therapy, sleeps.
10	Sud—	F.	64	5 „	3, 3, 1, 0, 2, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 6, 0, 6, 0, 3, 1, 0, 3, 0, 3	Noisy, agitated, hallucinated, delusional, insomnia, negativistic	Quiet, friendly, co-operative, still delusional.
11	Sad—	F.	36	10 „	15, 0, 6, 4, 4, 3, 0, 1, 2, 4, 6, 0, 2, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 4, 0, 0, 0, 0, 0, 0, 0, 7, 3, 0, 0, 0, 0, 0, 6, 4, 1, 0, 1, 1, 2, 3, 6, 0, 0, 0, 5, 3, 7, 5, 5, 3, 3	Destructive, degraded, stripping, mute, untidy, spoon-fed, insomnia	Tidy, speaks, works in ward and at occupational therapy, sleeps, eats well, still solitary.

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12	Bel—	F.	29	10	,,	6, 0, 0, 3, 4, 3, 0	Untidy, wet and dirty, mute, idle, negativistic	Clean in habits, tidier, still mute, more co-operative, little work at occupational therapy.
13	McL—	M.	19	5	,,	6, 3, 0, 3, 0, 3, 0, 3	Wet and dirty, untidy, spoon-fed, idle, resistive	Clean in habits, tidier, eats well, more co-operative, still idle.
14	McK—	F.	29	4	,,	6, 6, 2, 3, 0, 3	Wet and dirty, untidy, mute, idle, resistive	Clean in habits, tidier, more co-operative.,
15	Sta—	M.	44	18	,,	8, 2, 2, 0, 2, 0, 4, 2	Wet and dirty, untidy, destructive, idle	Clean in habits, tidier, works in garden.
16	Dou—	F.	43	5	,,	3, 0, 3, 2, 2, 3	Noisy, wet and dirty, destructive, idle, impulsive	Clean in habits, tidier, works in ward, more co-operative.
17	Ro—	M.	33	4	,,	5, 3, 0, 0, 3, 0, 2, 3, 4, 0, 2, 0, 0, 2	Hallucinated, delusional, irritable, idle, insomnia, aggressive	Co-operative, works hard, sleeps, parole.
18	Twi—	M.	23	1	year	8, 5, 4, 0,† 0, 0, 0, 0, 2, 3, 1, 3, 0	Hallucinated, delusional, aggressive, irritable, idle, insomnia	Co-operative, works hard, sleeps, parole.
19	Wal—	F.	40	6	years	9, 3, 3, 3, 3, 0, 0, 2, 1, 0, 0, 0, 0, 0	Hallucinated, delusional, aggressive, irritable, idle	Co-operative, works hard, parole.
20	Hen—	F.	46	3	,,	3, 0, 0, 0, 0, 4, 0, 0, 3, 0, 0, 0, 0, 0, 0, 0	Hallucinated, delusional, irritable, unco-operative, insomnia	Co-operative, works hard, parole, sleeps.
21	Wil—	M.	41	13	,,	4, 6, 2, 0, 0, 5, 0, 3, 1, 1, 2, 3, 1	Mute, resistive, untidy, wet and dirty, destructive	Clean in habits, not destructive, idle.
22	Goo—	M.	36	8	,,	6, 0, 0, 3, 4, 2, 0, 0	Hallucinated, delusional, noisy, irritable, idle, insomnia	Quiet, sleeps, works.
23	Irw—	F.	63	22	,,	6, 0, 0, 0, 2, 0, 2, 3, 2, 2, 3	Hallucinated, delusional, noisy, untidy, spoon-fed, manneristic, idle	Quiet, tidy, eats well, mannerisms disappear.
24	Gar—	F.	52	6	,,	5, 4, 3, 0, 2, 2, 3	Dull, apathetic, idle, untidy, faulty in habits at times	Brighter, does a little work mechanically, clean in habits.
25	Lev—	F.	18	5	,,	6, 5, 3, 3, 3, 4, 3, 3, 3, 0, 0, 0, 0, 0, 0, 0, 0, 3, 0, 0, 3, 0, 5, 3, 4	Stuporose, spoon-fed, mute, wet and dirty	Friendly, speaks freely, habits clean, goes to occupational therapy, plays piano and sings, plays games.
26	Cay—	M.	27	5	,,	2, 1, 0, 0, 0, 4, 0, 0, 0, 0, 3, 2	Hallucinated, delusional, aggressive outbursts, violent and destructive, noisy, insomnia	Quiet, co-operative, sleeps.

* Permission for treatment withdrawn by family during the ten months without fits. Relapsed during this period.
† For three months the patient was on insulin treatment.

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TABLE II.—*Group of Chronic Schizophrenics—Failures.*

Number.	Name.	Sex.	Age.	Duration of illness.	Number of monthly treatments.	Clinical picture. Before.	Clinical picture. After.
27	Aff—	F.	47	20 years	4, 3, 4, 0, 3	Wet and dirty, untidy, demented, idle	Improved for one week only.
28	Joh—	F.	36	18 ,,	6, 3, 6, 0, 3	Wet and dirty, mute, idle	,, ,, ,,
29	Ca—	M.	34	5 ,,	12, 0, 3	Demented, impulsive, window smasher	No improvement.
30	Div—	M.	29	7 ,,	8, 0, 0, 0, 0, 0, 0, 6	Hallucinated, delusional, impulsive, violent, aggressive	,, ,,
31	Mak—	F.	49	16 ,,	6 (1939), 11 (1940)	Noisy, impulsive, wet and dirty, resistive, aggressive	,, ,,
32	Hum—	M.	31	5 ,,	8 (1938), 9 (1939), 7 (1941)	Hallucinated, delusional, impulsive, aggressive, window smasher	,, ,,
33	Bro—	F.	30	15 ,,	11 (1938), 10, 0, 6, 0, 0, 3, 3, 3, 2 (1940–41)	Hallucinated, delusional, noisy, impulsive, aggressive, wet and dirty	,, ,,
34	Cla—	M.	39	10 ,,	6, 6	Hallucinated, delusional, noisy, untidy, destructive	,, ,,
35	Ste—	F.	52	5 ,,	6, 3, 0, 3, 0, 0, 0, 0	Hallucinated, delusional, noisy, aggressive	Improved, quieter and more co-operative for a time, but refused further treatment.
36	Fos—	F.	44	3 ,,	7, 4, 4, 1, 2, 1, 2, 0, 0, 0, 0, 0, 4, 3	Hallucinated, delusional, aggressive outbursts, destructive	Little improvement.
37	Mar—	F.	54	12 ,,	6, 0, 0, 0, 0, 0, 0, 0, 0, 0, 5, 0, 0, 0, 6, 3, 6, 7, 6	Hallucinated, delusional, noisy, destructive, violent	Improved after first treatments. Recent courses were ineffective.

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TABLE III.—*Group of Involutional and Senile Melancholias.*

Number.	Name.	Sex.	Age.	Duration of illness.	Number of monthly treatments.	Clinical picture. Before.	Clinical picture. After.
38	McG—	F.	70	1 year	6, 1, 2, 2, 2, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0	Depressed, insomnia, delusional, spoon-fed, wet and dirty	Eats, sleeps, clean, parole.
39	Sal—	F.	53	5 years	6, 4, 1, 0, 0, 0, 3, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0	Depressed, delusional, resistive, wet and dirty	Clean, parole.
40	Pip—	F.	46	3 „	2, 3, 2, 0, 0, 0, 3, 5, 3, 6, 0, 2, 3, 5, 3, 3, 3, 3, 5, 3, 3, 2, 1, 0, 0	Depressed, delusional, spoon-fed	Still depressed, but friendly and sociable, eats and sleeps, works.
41	Jar—	F.	61	8 „	3, 3, 4, 3, 1, 0, 3, 0, 3, 3, 0, 0	Depressed, restless, agitated, insomnia	Brighter, quieter, sleeps well.
42	Ged—	M.	56	1 year?	7, 5, 2, 3	Agitated, depressed, wet and dirty, tube-fed, idle, in bed, insomnia	Brighter, works at occupational therapy, clean, eats, sleeps.
43	Mur—	F.	54	2 years	4, 4, 0, 0, 0, 0, 0, 0, 3, 3, 0	Agitated, depressed, restless, noisy, insomnia, wet and dirty, idle, suicidal	Mildly hypomanic, friendly, sociable, works in ward and at occupational therapy, clean in habits.
44	Jon—	F.	65	10 „	6, 3, 0, 3	Agitated, depressed, solitary and seclusive	Cheerful, friendly and sociable, works at occupational therapy and attends all amusements.
45	Car—	F.	71	6 „	8, 0, 0, 8	Agitated, depressed, noisy, insomnia, untidy, idle	Brighter, interested, occupied, tidy, quiet and co-operative. Retains her nihilistic delusions.

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Six such cases were put on maintenance treatment in the hope of aborting their periodic illness. Although not followed up for a sufficiently long time to assess the ultimate value of the treatment, the results in this series are most encouraging.

CASE 46.—Male, aged 38. In hospital five times: 1930, six months; 1934, five months; 1937, eight months; 1940, two months; 1942, two months.

When out of hospital patient is a mechanic and for some years now has been doing responsible work on aeroplane engines. He is married and has three children, of whom he is fond. His frequent illness has led to a certain amount of marital strife. He is popular, sociable, keen on his work and has plenty of outside interests.

On each occasion his breakdown has been heralded by a period of mild depression, when he felt inadequate, thought he was not doing his work properly, that people despised him and that his wife no longer cared for him. He slept badly and found it hard to concentrate. When this state of affairs became intolerable he came to hospital as a voluntary patient. On the first three admissions depression was shortly followed by a manic phase, when he was restless, showed flight of ideas, talked incessantly, slept and ate very little and had to be nursed in the acute ward. The mania lasted a few months, gradually subsided, and he was discharged five to eight months after admission.

In 1940 he was given cardiazol two days after admission, and following six injections he began to improve and after a period of convalescence was discharged, the expected manic phase having been aborted.

In 1942 convulsion therapy was given two weeks after admission. During this time he had passed from a state of mild depression to one of excitement, when he was restless, talkative and did not sleep. Schizoid features appeared which had been present in previous manic attacks. Delusions of his wife's unfaithfulness, hallucinations and feelings of influence. At this stage he was given a course of eight electrically induced convulsions, which brought him back to normal. After a month's convalescence, during which he appeared normal in every way, he was discharged—two months after admission.

On the last two occasions the worst phase of this man's illness was avoided and his stay in hospital cut short very considerably. It seems probable that if the treatment is given early in the initial phase of future depressions the whole attack may be aborted.

CASE 47.—Female, aged 46. Has been in hospital fourteen times since 1916 for periods varying from one month to eight months, the average being four months.

She was usually silent, sullen and at times semi-stuporose on admission. After a few weeks she became noisy, excited, restless and violent. At times she had to be tube-fed.

On her last three admissions in 1938, 1941 and 1942 she was given convulsion therapy. On the former two occasions four cardiazol fits and this year two electrically induced fits were given. Each time the response to treatment was immediate, she at once regained normality and was discharged after a month's convalescence. Here again the most difficult phase of the illness was avoided and stay in hospital shortened.

CASE 48.—Male, aged 47. In and out of hospital on many occasions since 1912. Has been in hospital now for almost two years. During this time he has been well for three to four months —then "off" for six to eight weeks. At best he is a quiet, sensible, hardworking man who enjoys full parole. Rather simple, but capable of being given responsible work on the farm. When unwell he is restless, depressed, irritable, mildly confused, sleeps badly and requires sedative.

Ten months ago two fits at the beginning of a depressed phase aborted the attack. Since then two further attacks have been aborted by three and two fits respectively. This means that except for a few days at the time of each treatment he has been well, at work and on full parole.

CASE 49.—Female, aged 53. In and out of hospital between 1916 and 1924; permanently in hospital since 1924.

For some years now she has had well periods of about a year's duration alternating with manic periods of about six months. Of late there has been a tendency for the length of the two periods to approximate.

At best she is a pleasant, hardworking woman who has full parole. She is rather facile, but capable of doing responsible house work in the nurses' home.

When ill she is elated, restless, talkative, with some flight of ideas, inaccessible and unemployable. She goes off her food, becomes emaciated physically, sleeps badly and requires large doses of sedatives. Eight months ago at the beginning of a manic phase she was given six convulsions which brought her at once to her best level. Since then five groups of three fits at intervals have kept her well. This means that during the past eight months instead of being in acute mania requiring constant attention and large amounts of sedative she has been at her work except for a few days at the time of each treatment.

One can expect that she will shortly pass into a phase when for months at a time she will be well, corresponding to her usual good phase.

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CASE 50.—Female, aged 59. Has been ill on and off since 1907, and has been in hospital all this time.

When well she is fairly normal in speech and behaviour, though rather facile, with some emotional shallowness. She works well in the ward and takes an enthusiastic part in the various social functions of the hospital.

In her " off " phase she is elated, shows flight of ideas, is noisy and aggressive, struts about the ward or garden in a defiant fashion and is quite unemployable and inaccessible. She is very untidy, faulty in her habits and sleeps badly. Her manic phases last 3–4 months and her good phases, which are becoming of much shorter duration in recent years, from two weeks to two months.

Five months ago three fits during a manic phase brought her to her best level—since then eleven fits at intervals have maintained this.

CASE 51.—Male, aged 46. Ill off and on for the past 20 years ; in hospital for the same period. During this time he has had periods of comparative normality, when he has been active, interested and fully occupied. Alternating with these have been periods when he is restless, depressed, irritable and inaccessible. He then paces up and down the ward or garden muttering unintelligible nonsense. There has been considerable deterioration in this patient, but at best he is pleasant, co-operative, works in the carpenter's shop and attends the hospital amusements.

Over a period of eight months 22 fits have kept him almost constantly at his best.

Group of Periodic Catatonics.

Three well established cases of this rarer type of periodic illness were put on maintenance treatment and it was found that the catatonic phases could be aborted or shortened. The following is an illustrative case :

CASE 52.—Male, aged 35. Has been ill at intervals for 17 years. The periods between attacks became progressively shorter until 1937. He was first psychotic in 1925 ; again in 1928, 1934, 1936 and 1937. Since this date his periods of relapse and intervals have been approximately the same length, about three weeks—the phases changing from one to the other with almost clock-like regularity. Admitted to Crichton Royal in 1939.

At his best he is a pleasant, well-behaved man who looks younger than his years. He works at occupational therapy and in the gardens and takes a keen interest in the games and social side of the hospital. He is facile, with a shallow affect and no insight.

During his attacks he lies in bed in a semi-stuporose state, hallucinated, confused, inaccessible and extremely restless. He is noisy, resistive and impulsive.

The phases change from one to the other quite quickly—though the nurses in the ward can usually tell for a day or so that the patient is going " off " by carelessness in dress, inattention and various mannerisms.

On admission thyroid in tablet form and thyroxine were given in large doses as recommended by Gjessing (4), but no improvement followed.

In April, 1940, the patient was given a three months' course of insulin therapy—during all this time he kept well, but relapsed three weeks after treatment stopped and resumed his former timetable of remission and relapse.

In September, 1940, he was put on maintenance treatment, and it was found that three fits given on alternate days would abort the attack if commenced as soon as the patient began to show signs of relapse. If he had relapsed to the stage of being in bed, the first fit enabled him to be up and about, and the other two brought him to his best level. He was kept free of catatonic symptoms by this means until September, 1941, when treatment was interrupted for two months, during which he relapsed and remained psychotic ; only on three days was he symptom-free. When maintenance treatment was resumed he required six fits during the first month to keep him well. Since then an average of four fits monthly has been needed.

Group of Mental Defectives.

Two low-grade hyperkinetic mental defectives were given the treatment in an attempt to improve their standard of behaviour. Although this group is small, improvement was sufficiently remarkable to justify giving some details.

CASE 55.—Female, aged 27, congenital idiot, in hospital 14 years. A small underdeveloped individual, whose only attempt at speech is an inarticulate cry. For years she has been noisy, destructive, faulty and filthy in her habits. Swallowed all kinds of rubbish. If allowed, would tear up and eat her rubber mackintosh. Had to wear strong suit and sleep in strong bed-clothes.

During the last nine months she has been given in all 15 convulsions at intervals, and in this time she has had no sedative of any kind, has been clean in her habits, not destructive, able to wear ordinary clothes and sleep in ordinary bed-clothes. Her physical health has correspondingly improved.

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CASE 56.—Female, aged 31, congenital imbecile, in hospital six years. Until admission was capable of doing mechanical work under supervision and of living at home. Admitted because of violent outbursts. After admission she was able to do laundry work, but gradually deteriorated, and for 18 months had been idle, untidy, wet and dirty, and quite inaccessible.

During the past five months she has been given nine convulsions at intervals, and has become brighter, tidier, clean in habits and now works in the laundry again.

It would be of interest if the method was tried out more extensively in mental institutions where a few difficult cases can have such a bad effect on the other patients.

DISCUSSION.

(a) *Influence on Individual Symptoms.*

Examination of the foregoing tables shows that symptoms are not uniformly influenced; some respond much more favourably than others.

Insomnia.

Without exception patients slept better. Many who needed regular doses of nightly sedatives, such as paraldehyde, bromide and chloral or barbiturates, subsequently slept without any drug. In the department of the hospital of which the writer is in charge, consisting of 650 patients where maintenance treatment has been used during the past year, the number of individual doses of sedatives of various kinds administered at night to patients other than epileptics was 278, compared to 451 during the previous year. That the already small amount of sedatives used was so markedly reduced may be fairly attributed to the use of convulsion therapy. That the use of sedatives in this hospital is kept at a minimum is shown by the fact that out of the 650 patients in this department at present, only 12 are on sedatives either by day or night.

Refusal of Food.

In every case the appetite improved. Patients previously spoon-fed, tube-fed or persistently under-feeding themselves subsequently ate well. Many made substantial gains in weight, e.g. in Table I 12 patients put on weight, the average increase being 16 lb. and the maximum 37 lb. Some patients who were previously bed-ridden lost weight, associated with increased activity.

Hallucinations and Delusions.

Hallucinations sometimes disappeared temporarily; more often they were only less disturbing. Patients previously noisy or aggressive apparently because of "voices" or other "interference" became more placid and co-operative, e.g. Cases 17, 18 and 19.

Delusional systems became of less importance to the patients and exerted less influence on their behaviour, but in no case of this series was any real insight gained.

Negativistic reactions likewise, although they did not entirely disappear, did not tend to interfere so much with the patient's daily routine. An example of how delusions fade into the background and the patient comes into temporary contact with reality is well illustrated by Case 4. This patient has a series of three fits every month. The first Sunday after the series she joins the other patients going to church. A week later her delusional world has again become so real that she will not believe it is Sunday and refuses to go to church. At this time she is still sociable, well behaved and sleeps well. At the end of another two weeks insomnia, resistiveness and faulty habits recur if treatment is not given.

Mutism.

Some mute patients made no attempt to speak after treatment though improving in other respects, e.g. Case 12. Others talked freely after treatment, but gradually slipped back into silence. This tended to repeat itself after each course of treatment, and this symptom usually reappears much sooner than others, such as faulty habits.

Examples of this type were Cases 14 and 21.

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Faulty Habits.

Out of 25 patients who were wet and dirty the symptom was cleared up and kept under control in 21. Two cases became clean during the course of treatment and for about a week afterwards, but as improvement otherwise was negligible continuance was not considered worth while. Both were long-standing hebephrenics, Cases 27 and 28. Two cases did not improve at all, i.e. Cases 31 and 33, and these represent a type of failure in which the impression is given that lack of response is due to the patient being in a particularly resistive phase of his illness. Other cases have been observed which failed to respond at first but did so when tried again at a later date. Such observations suggest that a latent periodicity is still present in cases which for some time have run a chronic course.

Destructiveness and Aggression.

In nine patients who were destructive of their clothes and bed-clothes the habit was cured and kept under control in seven. Impulsive destructiveness, such as window smashing, seems not to be influenced, e.g. Cases 29 and 32.

Aggressiveness was conspicuous in many of these patients, and one of the most pleasing features of the treatment was that this troublesome symptom was often ameliorated. Patients previously at constant war with the staff and other patients worked at occupational therapy and joined in social entertainments.

Like faulty habits, aggression was not controlled in Cases 31 and 33.

Mannerisms, Verbigeration and Stereotypy.

These symptoms tend to occur in a particularly deteriorated type of patient and usually are not influenced to any extent, e.g. Cases 5 and 21. In one case occurring with slight clouding of consciousness mannerisms disappeared—Case 6.

Physical Health.

In every case there was an improvement in general physical health, shown by a brighter expression, better complexion, more spontaneous and better motor response, increased tonus of muscles and skin, and often increase in weight.

(b) *Influence on the Disease Process as a Whole.*

Many of these remarks on individual symptoms apply mainly to the chronic schizophrenic group. It is obvious that in the manic-depressives the whole disorder is temporarily cut short and the convulsions can even prevent the patient going into a phase of illness, as in Case 47.

The difference between the two groups is presumably that the manic-depressives retain the possibility of a spontaneous reintegration of the personality which treatment merely hastens, while in chronic schizophrenics the disease process is largely irreversible in the absence of some outside stimulus. The fact that even in long-standing cases some improvement is possible supports Bleuler's (5) contention that deterioration in schizophrenia is often apparent rather than real. Cases such as 27, 28, 31 and 33 show that if the illness is of a certain type or has reached a certain stage, convulsions are not an adequate stimulus to evoke a favourable response.

The patients of this series were not given any special tests of intelligence or memory mainly because of their lack of co-operation. Therefore there is no unassailable proof that the treatment may not have caused some intellectual impairment of the kind which can only be detected by psychological tests. On the other hand, clinical observation has noted none of the well-known signs indicating organic deterioration of intelligence or of personality. Judgment, memory, adaptability to and appreciation of environment have been greatly improved. For the present it is clear that improvement is in no sense a " cure by dementia."

Repetition of treatment still brings the patient to as good a level as at the end of the first course. It may be that in time the convulsions will lead to permanent organic changes. Even if this does happen, treatment would have been worth while, since the level of behaviour before treatment was in many cases as low as any organic dementia could have produced. Conversely it is quite possible that

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the deterioration to be expected in the natural course of the disease may be slowed down. Again this can only be determined by further observation.

One is tempted to make use of the patients in whom different levels were influenced disproportionately to theorize about the mechanism of improvement in general.

A review of the symptoms shows that those most influenced, especially among the schizophrenics, were those usually associated with the instinctive level of the central nervous system. Such symptoms relate to sleep, nutrition, bladder and bowel control. Symptoms related to the higher psychological level, hallucinations, delusions and thought disorder were generally less affected. The results bear out the well-established theory that dissolution of the mental faculties is from above downwards or from the higher to the lower and that recovery is in the reverse order. Thus the instinctive activities which are the last to be affected in mental disorders are the first to respond when improvement sets in spontaneously or is brought about by treatment.

In the present work this theory can also be supported from the biological angle. Many workers believe that improvement following convulsion therapy is due to a sudden anoxia stimulating the metabolism of cerebral cells. In this case the response of symptoms attributable to the lower centres in the hypothalamus would be more apparent because of their more primitive type and higher resistance to the disease process. The more delicate cortical cells have suffered greater damage from the disease process and are therefore unable to respond so well.

Another hypothesis emphasizes that the epileptic fit stimulates the diencephalic centres of the autonomic nervous system which are believed to have an energizing effect on cortical function. For those inclined to think on these lines the varying response of different levels is easily explained.

Generally speaking, the use of the epileptiform fit as a therapeutic adjunct is not so startling if one looks at it from a biological angle. The fit is common to man and higher animals as a preformed reaction to certain stimulation of the brain. One can assume that such a universal physiological response may have a purposive value. In epilepsy it has undoubtedly an immediate beneficial effect on the mental condition of the patient, although its frequent repetition is thought to accelerate mental deterioration. Muskens' (6) idea of the detoxicating effect of the epileptic discharge may thus explain the results in other psychoses.

Conclusions.

One of the limitations of our present methods of physical therapy in the psychoses is that while lengthy remissions are often obtained in earlier cases, in most chronic cases improvement is fleeting.

What seems desirable is an efficient and harmless method of keeping the patient at his best level and preventing deterioration after treatment at an early stage, the ultimate aim being the prevention of chronicity. The only method available at present is convulsion therapy, and the results presented here suggest that maintenance treatment can keep some chronic psychotics permanently at a higher level.

Summary.

Chronic psychotics whose behaviour endangered their health, constituted a serious nursing problem, or whose mental state was one of misery were treated with electrically induced convulsions repeated at intervals, with the object of maintaining the improvement achieved after an initial course of treatment or of cutting short a particular phase of illness.

The patients included 37 chronic schizophrenics, 8 involutional and senile melancholias, 6 manic-depressives, 3 periodic catatonics and 2 mental defectives. All cases responded favourably except 11 of the schizophrenic group.

In some cases treatment has been in progress for over two years.

Clinical observation shows no appreciable deterioration in personality or intelligence as a result of continued therapy.

The results are discussed and an attempt made to correlate them with theories of convulsion therapy.

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I wish to thank Lt.-Col. P. K. McCowan, Physician Superintendent, Crichton Royal, who originated this investigation, for helpful suggestions and permission to publish these results. I must also thank my colleagues on the medical staff who treated some of these cases. I am especially indebted to Dr. W. Mayer-Gross, Director of Clinical Research, Crichton Royal, for his most generous help and encouragement in writing this paper.

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UNUSUAL PITUITARY ACTIVITY IN A CASE OF ANOREXIA NERVOSA

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The case about to be described showed during the 18 months when she was under close observation certain remarkable pathological endocrine features. These, viewed together and in retrospect, throw considerable light on the relationship between pituitary function and so-called anorexia nervosa, and introduce a broader conception of the latter somewhat misleading designation.

History.

A. M. J—, aged 22, occupation, clerical work in a Food Office, single, had normal mental and physical health until about 20. Following a disappointment in love she lost the desire for food, and subsequently ate very little. With the introduction of rationing she excused herself from eating by "leaving more for other people." When referred to the Burden Neurological Institute for investigation she was somewhat depressed, rather self-critical, and appeared to be over-anxious to make a good impression and to please. She was an intelligent, well-educated girl. There was no evidence of any major psychosis. She did not appear to be much affected by the love affair referred to above.

On the first examination she presented the following picture (see Fig. 1). She was of rather slender build, height 5 ft. 3 in., weight 3 st. 7 lb. She was extremely emaciated, with gross loss of fat and muscle bulk everywhere. The skin was dry and scaly; there was no dermographism. Hair of scalp was very dry, streaked with grey; there was a growth of short, downy hair all over the face except in the beard area where it was much coarser. The face was that of a woman much older than 22. Blood-pressure 70/50 mm. Hg; circulatory, respiratory, renal and nervous systems were normal. The thyroid could not be felt; the breasts were shrunken and seemed to have been underdeveloped; amenorrhoea had been constant for two years.

Hormone excretion: 17-ketosteroids 6·8 mgm. in 24 hours; gonadotrophic and corticotrophic hormone *nil* in 5,800 c.c. urine. There was marked physical asthenia, the patient being unable to pull the swingdoors of the ward open, in spite of the desire to exert herself and to work.

Course and development of illness.—The patient co-operated well and settled down at once in her new environment. A full general diet was prescribed, and she received psycho-therapeutic treatment which was carried out by Dr. Hutton. There was a quick response and a steady gain of weight noted as follows:

10.x.41: 3 st. 12 lb. (see Fig. 1).
10.xi.41: 4 st. 7 lb.
5.xii.41: 5 st. 3 lb.
5.i.42: 6 st. 2 lb.
23.i.42: 7 st. 1 lb.
21.iii.42: 8 st. 10 lb.
21.ix.42: 10 st. 8 lb. (see Fig. 2).

By 23.i.42 the appetite was very good, and the patient was discharged from hospital. The abnormal growth of hair on face and chin had practically disappeared. During the whole period of observation up to the present date there have been no true menses. On 5.vi.42 and again on 13.vii.42 there was slight bleeding with considerable pain for about two hours only.

The excretion of 17-ketosteroids showed the following increase:

10.x.41:	6·9 mgm. in 24 hours.	No gonadotrophic or corticotrophic hormone in 5,800 ml. urine.
5.xii.41:	5·3 „ „ 24 „	
3.v.42:	12·0 „ „ 24 „	Gonadotrophic and corticotrophic activity positive in 900 ml. urine.
21.v.42:	20·2 „ „ 24 „	

During the last 12 months, that is since about March, 1942, the endocrine picture has undergone a striking change. Besides the very considerable increase in weight (patient now weighs

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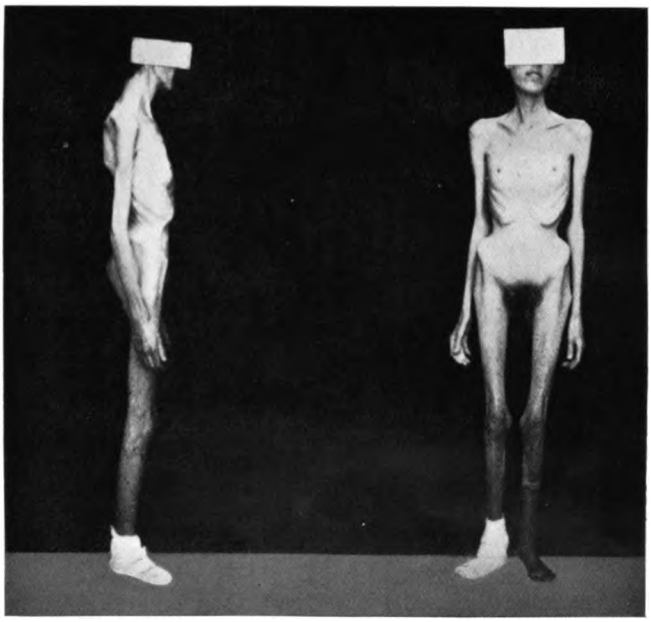

FIG. 1.

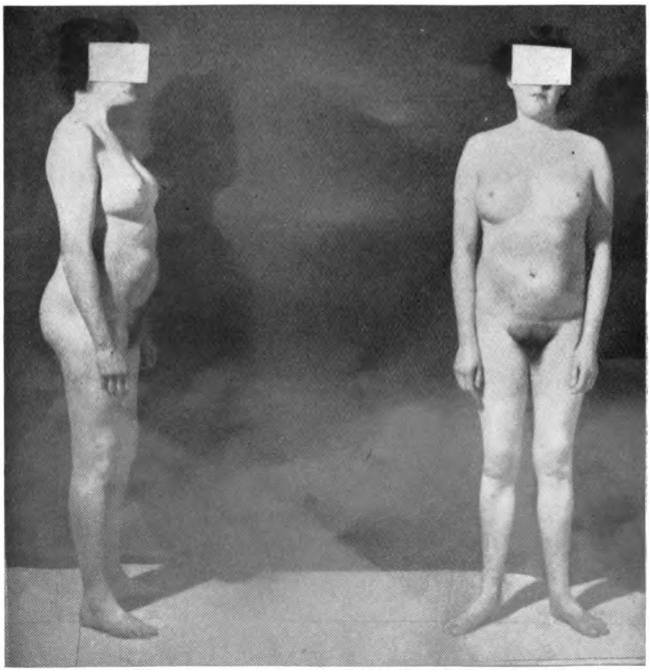

FIG. 2.

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over 12 st.) the patient has developed an adiposity chiefly round the trunk, neck and shoulders, the limbs remaining comparatively slim; the face is rounded, almost moonlike. She now experiences severe pain in the lumbar region on standing, has occasional fainting attacks, left-sided headaches and frequent bouts of giddiness. The fat distribution, increased excretion of steroids, general appearance and physical symptoms would at present suggest a pituitary adiposity of the type seen in Cushing's syndrome.

Reviewing the course of the illness, the patient at first presented a well-marked picture of so-called anorexia nervosa. The diagnosis is strengthened by the psychological history. The markedly subnormal excretion of anterior pituitary hormone of course indicated that the function of the anterior pituitary was greatly depressed. All the same, one was by no means justified in assuming the origin of this condition to have been primarily pituitary. Without any specific endocrine therapy anorexia disappeared, and there was a progressive increase in weight and loss of physical signs. However, the deposition of fat after returning to normal continued to increase at a rapid rate. Thereafter, fat was laid down unevenly, so that the picture was that of an adiposity. The conclusion must be drawn that, if the early condition followed a hypofunction, the latter represented a hyperfunctional state in the course of the illness. When the weight became excessive, the excretion of ketosteroids rose sharply to an abnormal level. As it is generally agreed, high output of the 17-ketosteroids reflects hyperfunction of the adrenal cortex. It may be assumed in this case that there was a hypercortico-adrenalism secondary to hyperfunction of the anterior pituitary. The future will disclose whether a growth enlargement is responsible for the headaches and giddiness now complained of.

The special interest of this case is its demonstration of how hypofunction of the anterior pituitary can swing to the opposite extreme of hyperfunction in a comparatively short time, when once something has occurred to upset its normal balance. Although this is the first time that it has been possible to follow such development closely, similar behaviour sometimes ensues from infectious complaints. The author has seen adiposity combined with virilism occurring in girls after an early attack of scarlet fever, a disease which frequently affects the adrenal cortex. The reverse is sometimes seen, as in fat children with raised intracranial pressure whose body shape becomes normal after puberty, or fat girls who became cachectic. But apparently such a rapid swing from emaciation to adiposity has not hitherto been described.

The function of the pituitary appears to be conditioned by an exact correlation between bodily demands and hormone production, the demands varying according to age and a variety of constitutional conditions. In very early life the chief production is that of growth hormone; later thyrotrophic hormone is produced, and at the time of puberty, gonadotrophic hormone in large quantity is poured out. Where there is a sudden and imperative demand for a hormone, an adequate increase may take place at once; for example, after castration or at the climacteric, when gonadal function has been arrested, gonadotrophic hormone is produced in response to the body want. The requirements for cortin after injuries are met by increased production of corticotrophic hormone. When this delicate regulative mechanism is upset, a pathological condition, perhaps resulting in physical illness, will develop.

The pituitary function is under the control of higher centres, and may even be influenced by psychic events in the life of the individual which carry a heavy emotional charge. The commonest example of the influence of psychic disturbances on endocrine activity is, of course, the amenorrhoea after an appropriate emotional upset in young women. Its direct mode of action may be mediated through the connections between the hypothalamic centres and cerebral cortex, so that cortical activity may inhibit or stimulate the anterior pituitary according to circumstances.

Taking into consideration the role of the pituitary in the development of the pathological symptoms, the early stages of the case can be interpreted as a *cerebral form of pituitary cachexia* manifested as anorexia nervosa, the latter designation being, of course, employed as a description only and not implying any particular etiology.

The relationship between anorexia nervosa regarded as " cerebral " and primary pituitary cachexia parallels that between cerebral and pituitary adiposity, cerebral

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and pituitary diabetes insipidus, amenorrhoea due to cerebral damage and to hypopituitarism. This interpretation is supported by comparing the main symptoms in anorexia nervosa and primary pituitary cachexia and analysing their development.

Anorexia is prominent in both conditions. It is due to lack of specific dynamic action and severe impairment of metabolism. Inability properly to metabolize food compels the body to resist the need for food and produces a true subjective aversion from it. There is no hunger; rather the opposite. The ability of "hunger-strikers" who are supported by various strong motives to endure fasts of several weeks' duration without the usual painful feelings of hunger has probably a similar explanation, and like anorexia nervosa, does not call for the phantastic interpretation of symptoms and physiological mechanisms on a basis of symbolization, such as "one has a baby by eating," advanced by Waller *et al.* (1940). If psychoanalytic methods can be credited with explaining the origin of anorexia, it is pertinent to ask why they do not account for the aversion for meat shown by typhoid patients, the thirst in diabetes insipidus, sugar hunger in diabetes mellitus, salt hunger in adrenal-cortical disorders, and many other subjective phenomena which rest on a well substantiated physiological base.

The emaciation of anorexia nervosa is similar to that of pituitary cachexia, and both types of emaciation result from primary disturbance of all regenerative and anabolic metabolic processes, and the secondary anorexia.

In both disorders the skin is desiccated and scaly, due probably to hypofunction of adreno-cortex and thyroid. According to Hemphill and Reiss (1942) the skin condition responds early to treatment with corticotrophic hormone.

Failure of production of gonadotrophic hormone accounts for loss of sexual function. In this case neither corticotrophic hormone nor gonadotrophic hormone were excreted in assayable quantities in the urine.

Asthenia, a prominent feature, is the result of hypoadrenalism secondary to ineffective production of corticotrophic hormone; it is usually more extreme in primary pituitary cachexia, where the pituitary may be grossly destroyed and, therefore, hypofunctional to a greater degree than in anorexia nervosa. Excretion of 17-ketosteroids, low in both forms, may be practically *nil* in severe pituitary cachexia.

Increased growth of facial hair present in this case and common in anorexia nervosa does not usually occur in primary pituitary cachexia. This cosmetic change, itself capable of delivering no light psychic trauma, can hardly have a primary psychogenic origin. It must be due to endocrine conditions which as yet are unidentified. Hirsutism in this patient disappeared as the weight approached normal. This might be accounted for in various ways, all of them speculative. Possibly the pituitary, while failing to excrete its normal hormones, the lack of which is responsible for the physical symptoms, produces another fraction which stimulates hair growth. Such a hormone might be deliberated by the adrenals. It would no longer be produced when normal hormonal conditions were established. This process would correspond to the lactation that sometimes accompanies amenorrhoea, when lactogenic hormone is produced as a result of disturbance of gonadotrophic hormone secretion. Lactation disappears if gonadotrophic hormone is injected.

Successful therapy naturally depends on the nature and severity of the diseases. In primary pituitary cachexia it is necessary to adopt replacement therapy, especially by corticotrophic hormone (and later, of course, also the other pituitary anterior lobe hormones). In anorexia nervosa a change in environment is essential, and if with encouragement the patient co-operates and takes an adequate diet early, hormone therapy may be superfluous. But unless there is a quick response, corticotrophic hormone should not be withheld. Its effect will be to stimulate appetite and combat asthenia as well as replace the hormone lack. It has been used with encouraging results by Hemphill and Reiss (1942). A rising output of ketosteroids, if the original figure was low, is an indication of the efficacy of the hormone (Hemphill and Reiss, 1942).

Summary.

1. A case, diagnosed as anorexia nervosa, has been described in which gross emaciation gave place to pathological obesity in less than 18 months.

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2. The significance of this change has been discussed, and it has been suggested that an original hypofunction of the pituitary became one of pathological hyperactivity.

3. Various endocrine features have been described, and the designation "cerebral" pituitary cachexia has been proposed for anorexia nervosa.

4. Appropriate lines of treatment have been mentioned.

I am indebted for some clinical notes to Dr. Hutton.

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OBSERVATIONS ON THE OCCURRENCE OF AN ETHNIC ELEMENT IN INVOLUTIONAL MELANCHOLIA.

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IN the development of involutional melancholia a variety of causes have from time to time been implicated, ranging from glandular upset of ovarian or pituitary origin to the stress of air-raids. In the bulk of cases the pathogenesis would appear to depend on the interaction of a constellation of predisposing and precipitating factors. In the present study a tentative attempt has been made to indicate a possible ethnic element in the aetiology of this psychosis.

Attention has been drawn to the fact that involutional melancholia is more often seen in association with the asthenic type of physique than with other types, and this coincidence has been contrasted with the findings in manic-depressive psychosis where the pyknic variety is prevalent. In view of the frequent occurrence of this psychosis in a particular racial background, it is perhaps permitted to inquire whether an ethnic factor may not be involved.

Differing views have been expressed about the correlation of physical with racial type. The prevalence of asthenics in Northern Europe has been contrasted with the predominance of pyknics in Central Europe, and comparisons have been drawn between these types and the ethnic groups of the districts. Thus asthenic has been associated with Nordic and pyknic with Alpine, whilst the athletic type has been compared with such widely differing ethnic prototypes as, on the one hand, the Dinaric (1), and on the other, the Atlantic (2). An entirely different line has been taken by Fischer, who has pointed out the occurrence of both pyknic and asthenic constitutional types in what he believed to be homogeneous ethnic groups. In accordance with this view the same racial type will therefore have members differing in their constitutional make-up, but alike in the fundamental features distinguishing the group, such as shape of skull or colour of skin. " Hence there are asthenic Alpines, pyknic Alpines, and so on, each type clearly distinguishable from the other. But the Nordic pyknic will also be distinguishable from the Alpine " (3).

As the criteria employed to distinguish the main ethnic types encountered in Western Europe are fairly well known the following brief account, taken largely from Stibbe's and Günther's works (4), may serve to illustrate the salient characteristics :

The Mediterranean, as exemplified by a Southern Italian, exhibits a dark complexion, dark, strong, wavy hair, prominent nose, dark to black irides, long face with light lower jaw, long head, short stature and light build.

The Alpine, as exemplified by many Swiss and Southern Germans, has a complexion intermediate between dark and fair, brown coarse and profuse hair, short nose, brown irides, face broad and round, broad head, short stature and thick-set build.

The Nordic, as exemplified by a Scandinavian, such as a Swede, shows a fair complexion, light, fine, wavy hair, high narrow and prominent nose, blue irides, long face, long head, and tall stature. By some regarded as a variety of Nordic and by others as a separate group is the type variously known as Heavy Blond, Cro-Magnon, Atlantic, or Dalic. This resembles the Nordic but differs in possessing a short broad face, and in having a taller stature and heavier build. People of this group occur most frequently in Central Sweden, Westphalia and Scotland.

In a mixed population any given individual is likely to bear genes inherited from a variety of racially diverse ancestors, whilst his outward appearance, or

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phenotype, may approximate to one particular racial group. Although the phenotype does not necessarily reveal the genotype or hereditary equipment, it does give a certain clue to racial membership (5). On this basis ethnic surveys have been used to ascertain the relative frequency of specific types in a mixed population, and provided it is borne in mind that such surveys concern phenotypes, their employment is unlikely to lead to such genetically unsound statements as that, for example, a brother and sister may belong to different pure races (6). The national terms English, Scottish, Irish and Welsh are cloaks for several ethnic stocks, for the most part present throughout the British Isles, but varying in proportion in different localities. Thus can be recognized people of predominantly Nordic, Mediterranean and Alpine types in all parts of the country. In addition there are small isolated groups, more particularly in Cornwall (7) and the Western Isles (8), where the Phoenicians have bequeathed to posterity their already mixed lineage of Oriental and Near Eastern races. According to the figures quoted by Günther, the proportion of main ethnic types in the population is 60 per cent. Nordic (including small Atlantic element), 30 per cent. Mediterranean, and 10 per cent. Alpine (9). The Nordic strain as a general rule is more pronounced in Scotland and the east of England, whilst the Mediterranean element is strongest in the south of Ireland. In passing, and in view of the political pseudo-scientific misuse of the term Nordic, it is interesting to note that Günther, a German of the pre-Hitler era, gives a lower estimate (50 per cent.) for the amount of Nordic stock in Germany.

In the investigation of a series of female involutional melancholics at the Northumberland County Mental Hospital, particular attention was paid to the ethnic types encountered. Over a period of 18 months 50 cases presenting the clear-cut, uncomplicated psychosis were investigated. Of these, 70 per cent. were predominantly Nordic, 8 per cent. Mediterranean, 2 per cent. Alpine, 2 per cent. Atlantic, whilst 18 per cent. were rather more mixed. A control series of 50 schizophrenics furnished 66 per cent. Nordic, 4 per cent. Mediterranean, 4 per cent. Alpine, and 26 per cent. mixed. In a further group of 30 manic-depressives there were 53 per cent. Nordic, 10 per cent. Mediterranean, 4 per cent. Alpine, and 33 per cent. mixed. On the whole, the differences between the involutional melancholic and schizophrenic groups were slight, and in view of the predominance of Nordic elements in Northumberland, these percentages might be a reflection of the geographic background from which the cases were drawn.

A feature of peculiar interest was discovered in the course of further examination. In the involutional melancholic group the presence was noted in 15 cases of a Scottish parent or grandparent, and in eight others of a corresponding Irish or Welsh ancestry. Thus 46 per cent. of the material was in this way affected. Moreover, an even greater prevalence of such strain seemed indicated by the occurrence of purely Scottish family names in six more patients whose immediate ancestry yielded no definite information. When, however, the control groups were examined, the presence of this strain could be ascertained in only 28 per cent. of the schizophrenics and 30 per cent. of the manic-depressives.

To obtain a proper perspective it is essential to consider the composition of the population from which this series has been taken. The county of Northumberland embraces a large and sparsely populated rural area, an extensive mining zone along the southern half of the coastal strip, and the industrial region on the north bank of the Tyne. Northumberland Mental Hospital draws its admissions from the entire rural and mining area and from the Tyne industrial region with the exception of the City of Newcastle. Like most border regions an admixture of peoples has taken place over many centuries. Moreover, Scottish blood has entered in increasing quantity since the Union, and as one indication of the amount of this contribution is the fact that 20 per cent. of the hospital population have Scottish names. More recently the development of the Ashington coal-fields and of the Tyne industrial basin has been a strong factor in altering the original population, and amongst others, a considerable amount of Irish and Welsh blood has been drawn to the county. Of ethnic types the Nordic is prevalent, but there has been considerable influx of other types coincident with industrialization—a factor particularly favouring Mediterranean stock (10).

Consideration of this mixed population, however, appears insufficient to account for the high proportion of Scottish ancestry in the series of involutional melancholics, and unless it is mere coincidence, which on the face of it seems unlikely, one is led

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to inquire whether such a strain is predisposed to involutional melancholia. This would seem to be the case. Henderson and Gillespie stress the prevalence of this psychosis in Scotland and quote the figures of the Royal Glasgow Mental Hospital for the period June, 1915, to December, 1919, when out of 299 admissions between the ages of 40 and 70, there were 97 showing anxiety states characteristic of the involutional period (11).

In countries where the Mediterranean occurs in greatest purity, as in Southern Italy, involutional melancholia is not recorded as being of especial frequency, whilst the Alpine strain would seem particularly associated with manic-depressive psychosis. As the prevailing type in Scotland is the Nordic it may be profitable to inquire into the forms of psychosis in other regions where this type is predominant, as in North-West Germany and, above all, in Sweden.

In North Germany von Verschuer pointed out the tendency of the predominantly Nordic North Germans to the schizothymic temperament associated with schizophrenia (12), whilst the material investigated by Henckel in Sweden showed that there were seven schizophrenics to every manic-depressive (13). As involutional melancholia was not mentioned as a separate entity, presumably manic-depressive was used in a Kraepelinian sense to include the former psychosis. This is in marked contrast to Scotland, where Henderson and Gillespie have, as already mentioned, stressed the prevalence of involutional melancholia.

It may not be without significance that the Nordic type in Sweden differs in certain respects from that in Scotland. The ethnic subtype in Sweden belongs to the Germanic wave, whilst that in Scotland includes both the Germanic and Celtic subtypes, a state of affairs also applying in Ireland. One essential difference then between the Swedish and the Scottish Nordic lies in a Celtic strain in the latter. As the two ethnic groups do not differ in their outward characteristics, one is tempted to speculate whether the occurrence here of involutional melancholia in a type associated elsewhere with schizophrenia may not be due to the presence of a Celtic element.

Although the evidence is incomplete, there are several suggestive features in favour of a connection between the original Celtic type and involutional melancholia. The well-known prevalence of the psychosis in Scotland has already been stressed. In the United States the Central Islip State Hospital has considered it worthy of note that although draining a population of very mixed origin, fully 25 per cent. of admissions of involutional melancholia occurred in patients of Irish origin (14)—a factor indicative rather of genetic than of environmental causation. In Bristol an abnormally high incidence of the psychosis has been noted (15). This city is situated in one of the two counties in the South-West where the Nordic type is prevalent (16), and if Fleure's view on the survival of a Celtic strain in this population be accepted (17), there would be presumptive evidence for the operation of a genetic factor. Finally there are the findings in the present series, where the majority of cases are of Nordic type, and where a strong infusion has been shown of a strain known to be prone to involutional melancholia.

Comparative philology locates the original home of the Nordic Celts in the valley of the upper Danube (18). The first wave, that of the Gaels, passed into Scotland and Ireland. In Scotland the type remained purer, subsequent blending being largely with the Germanic Nordics, whilst in Ireland the Mediterranean element reasserted itself to a greater extent. Conditions in Wales were rather different. The second Celtic wave, the Brythonic, formed a ruling caste over a large Mediterranean and Alpine population, and ultimately types representative of these latter groups tended to prevail (19). Of the continental Celts the type apparently remained purest in South-west Germany, and a leading authority on German ethnology was forced to admit that many a Nordic German might just as easily be of Celtic as of Germanic origin (20).

If there is a hereditary factor, then in order to be so widespread it is reasonable to presume that it arose at an early state in the development of this subtype. The genes for hereditary disease arise in the first instance by mutation (21) and spread throughout an isolate (22). Such a gene might be capable of producing a disease or only a diathesis, as in the case of acholuric jaundice (23). In the conditions under which the Celts became separated from the common stem such a mutation could have occurred and established itself in the group. The abnormality might then be linked to some particular characteristic or group of characteristics,

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and individuals possessing them would thus at the same time carry the liability to the disease. Such an association between disease and phenotypic component is shown, for instance, in the connection between xeroderma pigmentosum and the type of skin (24), or between the adenoid constitution and the shape of the nose (25). In a mixed ethnic stock a recombination of characteristics would be possible in the course of generations, and thus involutional melancholia could occur in individuals whose phenotype bore but a few of the characteristics originally associated with the disease. Where, however, the original stock persisted in a less diluted form, it would not be unreasonable to expect a greater incidence of the abnormal tendency in individuals of a phenotype originally associated with the tendency, and hence a greater incidence in a recognizable ethnic type.

Summary.

The unusual frequency of Scottish ancestry in the ascendants of a series of involutional melancholics has been commented upon, and the presence mooted of an ethnic element in the factors capable of predisposing to this psychosis.

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INVOLUTIONAL MELANCHOLIA.

A STUDY OF TWENTY CASES TREATED WITH THEELIN.

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IN the treatment of involutional melancholia the administration of oestrogenic substances has for years been a feature. The results achieved with this form of therapy have varied, some workers claiming unqualified success, and others recording no change, or even deterioration in their patients.

Werner, Kohler, Ault and Hoctor, in 1936, treated 21 patients with theelin over a period of six months and claimed 13 to be markedly improved (1). Using oestradiol benzoate, Jones, MacGregor and Todd treated 17 cases and found that six recovered with an average stay in hospital of three months (2). Schube and his colleagues treated ten cases with theelin, and not only obtained negative results in all cases, but also found three patients to be worse both mentally and physically (3). Ault, Hoctor and Werner, in 1937, treated a further 14 cases and were emboldened to state, " For all practical purposes theelin seems to be a specific in involution melancholia " (4). Again on the debit side Notkin, Dennes, and Huddart treated 15 cases, and at the end of treatment stated that three patients could still be considered somewhat improved, whilst two others were showing signs of improvement. Improvement in all cases was purely institutional, no patient being sufficiently well to resume life outside, and furthermore, at a recheck three years afterwards the entire group was found to have relapsed (5). Nevertheless, Ault in 1940 (6) was claiming a recovery-rate of over 90 per cent. in uncomplicated involutional melancholia, although he now recommended the employment of a much larger dosage.

Wittson, in a series of cases with a total dosage varying from 72,000 to 500,000 international units, over a period of 3 to 13 months recorded the following results: Recovered, 8·7 per cent.; improved and paroled, 21·7 per cent.; improved but not sufficiently for parole, 8·7 per cent.; unimproved, 60·9 per cent. (7). He criticized the results claimed by Werner, Ault and colleagues, and pointed out that the high recovery-rate was obtained by eliminating from the series those patients who failed to respond to theelin. Moreover, since a history of previous mental illness in their cases did not exclude the diagnosis of involutional melancholia, he wondered how many of their recoveries were manic-depressives.

During the past two years considerable work on the endocrine treatment of this psychosis has been carried out, in this country more particularly by Hemphill and Reiss (20, 21).

In the present series 20 cases were examined, the material being accumulated from the hospital population after the elimination of those where the symptomatology indicated an additional element of a paraphrenic, manic-depressive, or organic nature. Furthermore, patients over 60 years of age were regarded as less profitable subjects for investigation and treatment, and were left out of consideration. All the cases presented depression without retardation, anxiety, and the typical trends or delusions. The average individual dose of theelin was 10,000 units, whilst in the most resistive cases so large a dose as 100,000 units was employed in view of Ault's claim for the efficacy of heavy dosage. Of the total dosage the minimum employed was 32,000 units and the maximum 2,100,000. The minimum length of treatment was one month, the maximum six, and the average duration two months.

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In order better to assess the response to treatment, investigation was made into some factors bearing on the psychosis.

Influence of Heredity and Environment.

Twelve out of the 20 were found to have abnormal heredity in the direct, collateral, or atavistic line. Involutional melancholia, schizophrenia, neurasthenia and mental deficiency were encountered. Direct inheritance occurred in six cases, and of these mother-daughter transmission was apparent in four, whilst in a fifth both mother and father could be implicated.

With regard to environmental influences the usual finding of a greater rural incidence in involutional melancholia was confirmed in the present series. Twelve cases came from the rural areas and eight from the towns. There appeared to be an increased tendency towards recovery in the rural group, eight out of twelve, compared with the urban, four out of eight, and the average duration of the illness in the former group was considerably less than in the latter, 3·8 years compared with 5·1. Moreover, the average age at the commencement of the psychosis was 44·3 years in the rural series compared with 42·7 in the urban. Lest this should be a coincidence, all discharges of female involutional melancholics for the preceding three years were scrutinized. Although the higher rural recovery-rate was not substantiated, the other findings appeared to be borne out, for in the rural group the average duration was 1·15 years, and in the urban 1·5, whilst the average at onset in the rural was 45·6 years compared with 42·4 in the urban group.

Unless a purely regional factor is operative it seems not impossible that patients predisposed to involutional melancholia may have encountered greater adversity in the more intricate society of an urban environment, and thus developed their psychosis at an earlier age than they would have done in purely rural surroundings.

Prepsychotic Personality and Physical Type.

The prepsychotic personality in those people who develop involutional melancholia has been studied by various investigators.

Palmer and Sherman examined 50 cases from this aspect, and found constantly a definite reaction type wherein were featured marked introversion, sexual maladjustments, strong obsessional character, and hyper-religious trends (8). From a study of 80 cases Wittson found that a strong predisposition to involutional melancholia existed in the personalities of those women who developed the psychosis. He found the predominant characteristics to be quietness, sensitiveness, anxiety, over-conscientiousness, inability to confide in others, submissiveness, and sometimes stubbornness and jealousy (9). The present cases were in essential agreement with those last described. A tendency to be easily worried was prominent throughout, as were also such features as restricted interest, sensitiveness, reserve, marked conscientiousness, lack of sociability and timidity. A hyper-religious trend was noticeable only in one case.

The physical type met with was predominantly asthenic, 60 per cent., whilst pyknic comprised 25 per cent., and dysplastic 15 per cent. Bearing in mind the greater diversity of racial types in the United States, these percentages may be compared with the figures obtained at the Central Islip State Hospital, where from the investigations of 272 cases the findings were asthenic 43 per cent., pyknic, 37 per cent., and dysplastic-athletic 20 per cent. (10).

Relation to Menopause and Marital Status.

It has been pointed out that in a certain proportion of involutional melancholics the involutional period itself appears to be the most important factor in the aetiology (11), and the importance of this period as a time when anxiety normally mounts has been indicated (12). McCurdy, however, has given it as his opinion that physical change during involution cannot be the only factor (13), and this would seem to be borne out in the patients now under consideration. In all of the twelve cases where the psychosis coincided with the menopause other factors were present and the menopause was the last of a series.

Examination of marital status enabled four groups to be established—single, married and childless, married and with family, and widowed. Eight patients

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were single, four married and childless, seven married and with children, and one widowed. In the case of the single patients the love interest had not been entirely absent; two had had prospects of marriage, and the loss of these was probably contributory to their illness, whilst the promiscuity of a third seemed reflected in her delusions of sin. Of the four childless married patients three were poorly adjusted and marriage had occurred later in life. Of the seven married women with one or more children, six were happily married.

When the age at onset of illness and the duration of the psychosis at the commencement of treatment were compared in these groups, the following facts emerged:—Average age at onset and average duration at beginning of treatment: Single, 43·8 and 4·8 years; married and childless, 38 and 5·8 years; married and with family, 45·5 and 1·9 years. The single women in the series would appear to give some support to Stoddart's views on the "evil influence of a single life" (14), but on the other hand the pernicious effect of an unhappy marriage could be deduced even more. Of the third group five have left hospital as recovered. This is in keeping with the investigations of Palmer and Sherman in their 50 cases, where they found that all patients who had children and whose relation to them was good were in the group that recovered. They concluded that normal family life had a definite influence in diminishing the malignancy of the psychosis.

Other Predisposing and Precipitating Factors.

Psychic factors were prominent in most, and included financial worries and worry over future security, illness and death of relatives, unsatisfying or unhappy marriage, unsatisfactory childhood environment, and effects of war as manifested in air-raids and calling up or loss of relatives. Adverse childhood played a part in six cases, but in five of these abnormal heredity was also implicated. The effects of war were evident in seven cases and in three provided the final factor. In three other cases the precipitating factor was operative interference—ovariectomy, cholecystectomy, and operation on foot. One case developed subsequent to influenza.

It is noteworthy that of the five patients who responded most quickly and most satisfactorily to theelin there were fewer factors involved, in none of them was there an unhappy childhood, and in only one was heredity implicated. On the other hand, of the four who failed to respond there were adverse childhood conditions in three, abnormal heredity in three, late childbirth in two, severe physical disability in one, and additional psychic factors in all. Moreover the average duration of psychosis was two years in the first group compared with four in the second, prior to the commencement of treatment.

Investigation into the history of these patients revealed, then, that not one, but several factors, physical and psychic, contributed to the onset of their illness. Furthermore, those cases where factors such as abnormal heredity and adverse childhood were present, and where marked psychic trauma could be postulated, were those wherein the psychosis was severest and most resistant to treatment. Conversely, those cases where the menopause was partly causal and where other factors were less prominent tended to be of shorter duration and more responsive to treatment.

Endocrine Types.

From the endocrinological aspect three types could be discerned: those where no upset other than that characteristic of the menopause was present; those where hyperthyroidism was present in addition to ovarian dysfunction; and a group of pluriglandular insufficiency. The first group, by far the largest, was characterized by increase of fat in the typical ovarian sites and by vasomotor instability. Included here were those patients who were past the acute phase of glandular change and who did not show signs implicating glands other than the ovaries. A case of artificial menopause belonged to this group, and the initial severity of her psychosis was probably conditioned by operative interference (15).

Those in the second group, two in number, presented the usual signs of mild hyperthyroid activity, such as tremors, profuse perspiration, von Graefe's sign, marked vasomotor instability with tachycardia and extra-systoles, tendency to subfebrile temperatures, and increased basal metabolism.

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In the third group, that of pluriglandular insufficiency, two cases were hypothyroid and the third hypo-adrenal. The two former corresponded to Zondek's thyro-ovarian insufficiency (16), and were characterized by dryness and roughness of skin, dry, scanty and brittle hair, diminished perspiration, sensitiveness to cold, bradycardia, and a certain slowness of movement. Basal metabolic rate was reduced in both. The case of hypo-adrenia was lean, with a poorly developed musculature, and marked debility and fatigability. Considerable weight had been lost. Anorexia and gaseous distension were marked on admission and the skin was pigmented a light brownish shade, particularly noticeable on the face. The pulse was of diminished volume and blood pressure slightly reduced. The picture was in keeping with the mild and comparatively benign form of the syndrome to which the term "Addisonism" has been applied (17).

Effects of Treatment.

It became evident in the course of treatment that, depending on the response, there were four types of patient, namely those showing (1) pronounced improvement, (2) slight improvement, (3) no improvement, and (4) deterioration.

There were five patients where the effect of theelin therapy was pronounced, and where the oestrogen could reasonably be regarded as an important factor in their recovery. Here there was a definite correlation between the clinical improvement and the administration of theelin, and where a small dose, 1–2,000 units, was unsuccessful, increase of 10,000 units was associated with pronounced improvement. All showed evidence of ovarian dysfunction with, in one case, additional hyperthyroidism. Obvious signs of endocrine upset were present in four out of five, and fewer additional factors were ascertainable in this group than in any other. The action of theelin appeared to have a specific quality. Certain features in these cases are of interest. Excepting the patient with artificial menopause none of these women was childless, and their relation to their children was good. In none of them had there been an adverse childhood environment with its stultifying effects, and in only one could direct inheritance be implicated, and that incidentally in the case of longest duration. Evidence of financial strain was provided in not more than one instance, and bereavement figured in none. The onset, coinciding with the menopause, was rapid in four, and the psychosis lacked nothing in severity, two patients having attempted suicide, and a third being considered actively suicidal. It seems likely that endocrine dysfunction was of major import in this group, and that the improvement of the internal milieu consequent on the provision of oestrogen resulted in betterment of the mental state.

Coming to the second group, there were eight patients in whom oestrogen appeared to confer some benefit. The impression was obtained that oestrogen acted by accelerating a convalescence already in evidence, and by producing a sense of increased confidence. Improvement could in no case be compared with that seen in the first group (even though doses as high as 100,000 units were given), and whilst four of these patients were ultimately discharged, there appears considerable likelihood that this would have occurred in any case. At the time of treatment the physical concomitants of the menopause had passed off in five of the eight, and were in process of subsiding in two others. The operation of additional factors was more pronounced in this group, and included adverse childhood conditions in three, and abnormal heredity in six. It seemed probable that here a purely glandular dysfunction was not the essential element.

Belonging to the category not improved after oestrogen were four patients. Three were of the ovarian type, one showing hyperthyroidism as well, and in three the endocrine upset was prominent. Nevertheless, although such large doses as 100,000 units were employed, and even though theelin, augmented by hexoestrol, was administered up to a total of over two million units, no change in the mental state was discernible. It is perhaps significant that it was precisely here where the greatest accumulation of adverse factors occurred. Commencing with the hereditary equipment, of two cases the fathers were chronic drunkards; the first mother was likewise an alcoholic, and the second was an involutional melancholic who committed suicide; a third of this series had a bad family history of mental deficiency. Childhood again was particularly adverse in three. The two married women were poorly adjusted, one manifesting frigidity coupled with a morbid fear

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of pregnancy, whilst of the single women one had lost her fiancé, and the other had probably planted the seeds of her delusions of sin and disease in her earlier promiscuity. Factors additional to these were present in all. It seems feasible that the endocrine element was outweighed by the aggregation of influences prolonged in their application and pernicious in their effect, and this, therefore, may be the reason why endocrine treatment failed to elicit a response.

The final group, where a deterioration followed oestrogen therapy, comprised three members. A dose of 1,000 units produced little response, but when the individual dose was increased to 10,000 units and a total dosage of 100,000 units administered within a period of two weeks, a striking increase in agitation became apparent in all three cases. Depression deepened, delusions appeared more prominent, and in one patient a suicidal tendency manifested itself. An examination into the earlier history failed to reveal any particularly deleterious influence. Childhood had been uneventful in all, whilst abnormal heredity affected only one, and although other factors were present, their operation on the whole did not appear of particular intensity. When, however, the endocrine state was considered it was found that all belonged to the category of pluriglandular insufficiency and that two were undergoing the menopause, whilst the third, aged 45, may have been rapidly approaching this phase. Two were hypothyroid and the third hypo-adrenal.

Oestrone has been shown to produce hypofunction in the thyroid (18) and degeneration in the suprarenal cortex (19), and the further depression of these already underactive organs may well have been mirrored clinically in the mental state. On this assumption thyroid was administered to the first two and adrenal cortical hormone to the third, and in all three the mental state improved. One hypothyroid recovered and was discharged after two months. The other showed improvement only after six months, but although allowed home for four-day periods was not considered well enough for discharge; incidentally it was in this member of the group that the greatest number of adverse factors were ascertained. The hypoadrenal patient responded rapidly to adrenal cortex hormone and became bright and cheerful, but invariably relapsed as soon as the injections were discontinued.

Commentary.

In the preceding study an attempt has been made to evaluate endocrine therapy in relation to the recovery and improvement-rate, and the results have tended to show that in most cases a favourable outcome could not be attributed to any one factor.

With regard to oestrogens it was felt that a classification of patients according to response to treatment could be made out, and that this gave more accurate information of the relative importance of the part played by oestrogens in improvement or recovery. It was found possible to form four groups: those where oestrogen led to a pronounced improvement; those where a slight improvement resulted; those where no change occurred; and the group that was worse after oestrogen.

In five cases the administration of oestrogen was followed by a marked advance and recovery, and it seemed equitable to attribute to this treatment a large share of the credit. In 25 per cent., therefore, recovery appeared mainly due to oestrogen. Eight patients were benefited, the effect being apparent either in a slight lessening of depression, or in the improvement of cases where the severity of the psychosis was already diminishing. Although four of this group were ultimately discharged recovered several factors were operative in all, and the part played by oestrogen in no way corresponded to the specificity of action observed in the first group.

In the third group were four patients who showed no improvement even though receiving much larger doses than had the cases who recovered. Further comparison showed that adverse factors other than those of an endocrine nature reached their maximum in this group, and it appeared possible that the lack of response to oestrogen was due to the malignancy of these factors. Conversely, those cases which responded well belonged to that group where the minimal number of such factors could be ascertained.

Claims for the efficacy of larger dosage could not be substantiated from this series. The patients of the first group, all of whom recovered, received a total

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dosage varying from 32,000 to 254,000 international units, and in the latter case spread over months. Those cases which remained unimproved received much greater doses, one patient getting as much as 2,000,000 units in the space of a fortnight. The impression was conveyed that if a patient did not respond to a moderate dosage the exhibition of massive dosage was unlikely to be more successful.

Three patients were worse after treatment, and here an endocrine mechanism appeared definitely implicated. Polyglandular insufficiency was shown to be present, and it seemed that oestrogen, by upsetting still further the hormonal balance, brought about the deterioration in their state. The adverse results reported by others are explicable on such a basis. The administration of thyroid led to recovery in one and ultimate improvement in another, whilst suprarenal cortex hormone produced transient improvement in the third.

This study further illustrates the complex aetiology of involutional melancholia. Where an element of endocrine dysfunction was definitely present, and particularly where it was marked, the impression was conveyed that the glandular disturbance was of importance in contributing to the full development of the psychosis. Nevertheless, other factors were also present. Throughout the normal personality of these patients there kept recurring a tendency to be easily worried, sensitiveness, marked conscientiousness, lack of sociability, and timidity, so that these seemed characteristic of the usual prepsychotic personality. The prevalent physical type was the asthenic, in contrast with the general findings in manic-depressive psychoses. Heredity and environment also played their part. Direct parent-daughter transmission, including two instances of involutional melancholia, occurred in 30 per cent. of cases, whilst other 30 per cent. showed tainting and a preponderance of cases developed in a rural setting. The good prognostic value attributed to a happy family life seemed justified from the increased recovery-rate in the patients belonging to this series.

The existence of adverse physical and psychical factors could be demonstrated in the majority of the series, and their cumulative effect might well have been of considerable importance in the origin of mental illness. From the examination of this series it seemed that whilst the glandular factor was of considerable importance, no one factor, whether glandular or otherwise, was capable of inducing the typical picture of involutional melancholia. In most cases there was present a constellation of factors including endocrine upset, a particular physical type, hereditary weakness, unhelpful personality trends, and other adverse physical and psychical conditions.

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THE PITRESSIN DIAGNOSIS OF IDIOPATHIC EPILEPSY.

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As a rule, in hospital practice there is little urgency for a rapid diagnosis in idiopathic epilepsy to be effected, and doubtful cases can be submitted to prolonged observation until an actual seizure has resulted. There are, however, certain occasions when the necessity arises for the establishment of a definite diagnosis as early as possible. In the average hospital case, the period of observation necessary will be a matter of days or, at the most, a week or so, but in cases of irregular seizures at infrequent intervals, this period may have to be extended into months before any opinion can be offered. It is with a view to curtailing this period of observation that an attempt has been made in this investigation to determine a method whereby the condition can be diagnosed with a degree of certainty in the absence of seizures.

The circumstances under which it may be necessary to give a rapid opinion on the existence or otherwise of this condition will, of necessity, vary according to the requirements of the individual case, but the following indications may be shortly summarized in which the method adopted has been found to be of value :

(1) In order to differentiate between hystero-epilepsy and idiopathic epilepsy in doubtful cases.

(2) Where the existence of idiopathic epilepsy has been claimed by a patient in the absence of clinical evidence and a definite diagnosis has to be established.

(3) Where a diagnosis has to be established in a case where the history and clinical features are suggestive of the presence of idiopathic epilepsy, the existence of which is denied by the patient.

(4) Where a diagnosis has to be established as a result of various conduct abnormalities being attributed by the patient to the existence of idiopathic epilepsy.

(5) If, under any of the foregoing indications, there is an added urgency for legal reasons that a rapid diagnosis should be arrived at, and where time does not suffice for the usual method of continued observation by a trained observer until an actual seizure ensues.

At the present time these various indications are frequently encountered in the routine examination and assessing of cases in the Services, and the importance of reducing the period of observation necessary can be readily appreciated, with the resultant economy in time, expenditure and man power as well as the greater accuracy afforded in diagnosis.

The rationale of the method adopted depends upon the fact that retention of water in the body will precipitate a seizure in predisposed persons, while exerting little influence on normal individuals. In 1931 McQuarrie, studying the effects of prolonged pituitary anti-diuresis combined with increased fluid intake on young epileptics, found that seizures resulted in predisposed subjects but not in others. Working along similar lines, Temple Fay has drawn attention to the abnormalities in water metabolism as an important predisposing factor in the production of idiopathic epilepsy. Similar investigations have been carried out by Jacobsen and later by Clegg and Thorpe, who have made exhaustive studies on the relationship between the water balance of the body and the occurrence of seizures. Clinically, the frequency with which distension of the subarachnoid space is demonstrable in epileptic subjects, either by means of operative procedure or by encephalography, is of importance, while various observers have stressed the efficacy of hydragogue cathartics in the reduction or averting of seizures without associating this finding with the water-balance of the body, and rather attributing the beneficial results obtained to the removal of toxic substances from the body.

While certain observers, notably Fay, McQuarrie, Teglbjaerg, Peeler and Ziskind, have stressed the fact that the frequency of the seizures can be increased by hydration of the organism, either by the administration of water alone or by

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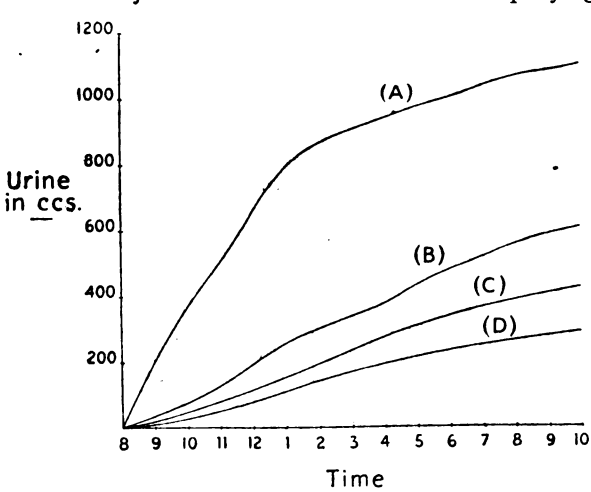
the administration of excessive amounts of fluid in combination with anti-diuretics, others, especially Cameron, Jansen, Wilson and Limberger, have opposed this view, and express the opinion that there can be but little reliance placed on the relationship between the onset of the seizures and the water content of the body. Similarly there are those who maintain that the frequency of seizures can be diminished in a patient either by restriction of the fluid intake or by other means, while there is an opposing view that such measures have a negligible effect upon the incidence of seizures. The work of Greville, Jones and Hughes in this direction has done much to clear up the problem. These observers in an exhaustive study of the water metabolism in idiopathic epilepsy find that " it is probable that when there was a large rise in weight during the two days before a fit or a large fall during the two-day period, consisting of the day of the fit and the following day, these weight changes were for the most part due to changes in the water content of the organism." They have found that retention of body water does not invariably precede a seizure, finding that in the case of isolated seizures a negative water-balance was commonly encountered. They have put forward the view that the tendency for retention of body water is to be associated with a decrease of the total solid content of the blood. By experiment they have ascertained that the blood total solids and the plasma proteins tend to undergo parallel changes, thereby suggesting that the changes found are due to the presence of water entering and eaving the circulating blood. The value of these findings in relation to the water metabolism of the body can at once be appreciated.

The establishment of a positive water balance in a selected subject can be obtained by the prolonged ingestion of copious amounts of water alone, but this method requires the expenditure of a considerable amount of time and frequently leads to lack of co-operation on the part of the patient, and in some cases to actual refusal to continue with the investigation. More rapid results are obtained by the oral administration of copious amounts of water accompanied by pitressin intra-muscularly. This is the pressor and anti-diuretic principle of the posterior lobe of the pituitary, as distinct from the oxytocic. This substance has the property of causing marked water retention in normal individuals, while having the subsidiary effects of stimulating the involuntary muscle of the gastro-intestinal and genito-urinary tracts and slowing the pulse.

By means of anaesthetized animal experiments, it has been found that pitressin, even in small doses, produces a temporary polyuria followed by a reduction in output which in time amounts to an almost complete stoppage of the flow. In non-anaesthetized dogs the anti-diuretic effect is well marked, and similarly in the human subject this is the predominant effect. The effect of pitressin in causing water retention in a normal subject is demonstrated in the accompanying chart.



A is the normal curve, showing the accumulative excretion of urine, resultant upon the ingestion of 1,000 c.c. of water at 8 a.m. The curve reaches its zenith

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after the expiry of 5–6 hours and remains at a fairly constant level thereafter. B shows the effect produced by the injection of 1 c.c. pitressin under similar conditions.

C and D show the effect produced by injections of 2 c.c. and 3 c.c. pitressin respectively.

It is seen that even in small doses this substance has a well-marked anti-diuretic effect on the human subject.

On account of the physiological properties of pitressin there are certain contra-indications to its use as a diagnostic measure. These are mainly the presence of diabetes, nephritis, arteriosclerosis and myocarditis, and it is advisable to eliminate the existence of these conditions before commencing the investigation by a routine urinary examination, with an estimation of the blood pressure and a cardio-vascular examination.

The test adopted was carried out in the following manner: The patient under investigation was confined to bed throughout the test. The bowels were opened by an enema, urine was voided and the patient weighed at the outset of the examination. Ordinary diet was maintained throughout, any previous sedative therapy was discontinued, and encouragement was given to drink copious amounts of fluids. The amount ingested and the urinary output were measured and charted daily, while the patient was weighed morning and evening. An increase of 2 per cent. in the body weight with the ingestion showing an excess over the excretion was accepted as evidence that a positive water balance had been established (earlier observers stressed the importance of there being a 3–6 per cent. increase, but this standard was abandoned in the early stages of the present investigation, as the period necessary to obtain this additional increase defeated the purpose of test). The average period required with a co-operative patient carefully supervised for the establishment of a positive water balance was 48 hours. Throughout the investigation certain non-susceptible patients were used as controls.

When a satisfactory water balance had been attained, ·25 c.c. of pitressin were injected intramuscularly and 300 c.c. of water were administered orally. Thereafter ·5 c.c. of pitressin were injected, and 300 c.c. of water were given orally every two hours until ten injections in all had been administered. On the occurrence of a seizure the treatment was stopped immediately, but otherwise the course was continued until the full course of injections had been given.

In every case pallor followed the administration of pitressin within a period of five minutes of injection and lasted on an average for a period of three hours, disappearing after the second or third injection, but in a few cases this continued at a uniform level throughout the investigation. The physiological action of the drug was displayed by the slowing of the pulse and the tendency to looseness of the bowels, but these features were in no case of sufficient severity to merit the cessation of the investigation.

The positive evidence that idiopathic epilepsy is present depends upon the development of an actual seizure, which may be either of the major or minor type. Failure to produce such a result does not necessarily mean that the patient is non-susceptible, and in doubtful cases may be followed either by a second test or by a period of prolonged observation before an opinion can be reached. The seizure in susceptible cases has been found to result most frequently after the fifth or sixth injection, that is, after a period of 8–10 hours from the institution of the investigation, but in certain cases this may be delayed until after the tenth or final injection. In others a positive result may be obtained in the initial stages after the first injection.

The combination of establishing a positive water balance and administering pitressin seems to be necessary in the production of the seizure, for cases treated with pitressin alone without previous adjustment of the water balance failed to react, while no result was obtained in those cases where a positive water balance was established alone and not followed by administration of the drug. The control cases which were previously known to be non-susceptible and were similarly treated throughout the investigation displayed the physiological effects of pallor, slowness of the pulse and looseness of the bowels, but in no case did an actual seizure of either type ensue. This specific action enables a differential diagnosis between the hysterical and idopathic types to be readily established without a period of prolonged investigation.

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This test was carried out on 87 cases in which it was desired either to establish or to eliminate the possibility of idiopathic epilepsy. The following tables summarize the results obtained in the investigation:

TABLE I.—*Results in Cases in which the Presence of Idiopathic Epilepsy was Suspected from the History or Clinical Features but its Existence was Denied by the Patient.*

Number of cases treated.	Number in which a positive result was obtained.	Number failing to react.	Number stopped. Reason for terminating.	Number in which further history agreed with the test results.
49	45	1	3 2 persistent nausea; 1 died.	39

TABLE II.—*Results in Cases in which the Presence of Idiopathic Epilepsy was Claimed by the Patient, but there was no Clinical Evidence in support of this.*

Number of cases treated.	Number in which a positive result was obtained.	Number failing to react.	Number stopped. Reason for terminating.	Number in which further history agreed with the test results.
38	8	28	2 1 unco-operative; 1 water balance failed to be established	7

TABLE III.—*Results Showing the Position in the Course of the Investigation at which the Seizure Resulted.*

Number of cases treated.	Number of positive results.	Number of pitressin injections.									
		1.	2.	3.	4.	5.	6.	7.	8.	9.	10
87	53	2	1	2	4	19	17	0	0	2	6

In every case the patient was kept in hospital under observation for a period of one month after the termination of the test for the purpose of obtaining corroborative evidence, or until such time as a seizure resulted if this period were less than one month. In those cases in which no evidence was forthcoming at the expiry of this period discharge or boarding took place, and the subsequent medical history was followed up through the intermediary of the family physician.

The above tables show that only 1 out of 49 cases which were susceptible failed to react, and that out of the 45 cases which gave a positive reaction, 39, or 86·6 per cent., were later found to furnish corroborative evidence; in the second group positive evidence was furnished by means of the test in 8 out of 38 cases at the expiry of 72 hours, which would otherwise have required a prolonged period of observation, and out of these 8, 7 later furnished corroborative evidence in the light of the subsequent history.

In only 1 out of the total of 87 cases did a positive water balance fail to be established and result in the interruption of the investigation, while 2 cases had to be terminated on account of the persistent nausea which persisted in spite of various forms of treatment. These findings are in keeping with Jacobsen's original research on 40 patients, mostly children and known epileptics, in whom a seizure was induced in every case by the use of pitressin after the water balance had been satisfactorily established, while the investigations of Clegg and Thorpe, under similar conditions, obtained positive evidence in a complete group of 16 adult epileptics.

As experimental water intoxication in animals results in the onset of convulsive seizures and vomiting, and although epileptic phenomena can be more readily produced in animals than in man, it is reasonable to deduce that some relationship exists between the water balance of the body and the onset of the actual seizure in man. The epileptic's nervous system appears to be unstable and unduly easily influenced by minute changes in the osmotic pressure of the body fluids. As water retention is accompanied by a lowering of the osmotic pressure of the blood serum, it is considered that the precipitating factor productive of the actual seizure is the resultant exudation of fluid into the intra-trabecular spaces, and that subsequent to the seizure the osmotic pressure of the blood serum returns to the normal level. The specific *modus operandi* of the anti-diuretic effect of pitressin is not yet fully understood, but the water elimination is probably retarded by a change in the

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permeability of the cell membranes and the establishment of a new balance between water lost (dehydration) and water concentration (hydration). Whether the precipitating factor is controlled and influenced by allergic, endocrine, dietetic, psychological or other factors has not yet been ascertained, and further work along parallel lines will be required before a definite statement can be given as to the actual causation. The value of this therapeutically has been claimed by certain observers, who state that beneficial results follow in susceptible cases by the employment of a diet with a minimum fluid intake, although, to be effective, the course of treatment must be prolonged over a number of years, and this is liable to lead to a degree of distress to the patient with a consequent discontinuance of the routine.

Conclusions.

A method of investigation suitable for use in cases of suspected idiopathic epilepsy has been advanced. The method possesses an advantage in that an accurate opinion can be given with great rapidity. In the average case this period will be that of 72 hours, consisting of 48 hours for the establishment of a positive water balance and a maximum period of 24 hours for the purposes of the actual investigation. The advantage of this from the point of view of grading service cases at the present time can be appreciated, while in civil life it offers certain economic advantages to hospital and out-patient treatment centres.

The accuracy of diagnosis as verified by a subsequent follow-up of cases has been placed at 86·6 per cent. after a prolonged investigation on 87 unselected cases of average adult age.

The method possesses the advantage of simplicity of application and interpretation of results. The period of observation is reduced to a minimum, and need only be subsequently employed in those cases in which a positive result has not been obtained.

A suggestion as to the causation of the actual seizure has been advanced and further lines of investigation indicated.

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ONE HUNDRED DEPRESSIVE PSYCHOSES TREATED WITH ELECTRICALLY INDUCED CONVULSIONS.

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Introduction.

Since the introduction of the electrically induced convulsion by Cerletti and Bini the history of this procedure has become too well known to record again; but certain clinical data have come to light that are worth noting, of which the most important is the now recognized fact that this treatment is of more value in the affective psychoses than in schizophrenia, for which it was early introduced. Most writers, e.g., Elfield, Metcalfe and Paul, are agreed upon this, and it would therefore seem worth while to examine the results of this therapy in one hundred such cases. Depressions are so much commoner than manias that it would take a long time to collect a sufficient number of the latter for reliable conclusions to be drawn. These remarks are thus confined to the depressive states.

Material.

All of this series of depressive psychoses were severe enough to be admitted to a mental hospital. They are consecutive, and the only selective factor involved is the type of case admitted to St. Ebba's Hospital. They are all females, because these are the only ones to which the routine method described below was applied. The legal status of the case is of no importance for our purpose.

All psychiatric cases admitted to St. Ebba's Hospital have been previously seen by experienced psychiatrists, and the hospital is designed primarily for the treatment of those whose prognosis is good. It will be noted that neither the duration nor the severity of the condition is a prominent guide in the choice of material.

Method.

Therapy is administered to each patient twice a week, and on no occasion was a subconvulsive dose used, for either the voltage or the operational time of the current was increased until a fit resulted. The reason for insisting on a fit was that such cases seemed to do better than those only subjected to subconvulsive doses. The patient is fasting at the time of treatment, and apart from the cleansing of the skin at the site of the application of the electrodes with methylated ether no other preparation is used. This has been found quite satisfactory, and removes the necessity of both more prolonged cleaning and the application of pastes or jellies; good conduction invariably results.

The patient lies on an ordinary " theatre " trolley upon which is placed a fitted mattress. She is then covered with a six-foot sheet of strong material, to the sides of which are sewn straps, six feet in length, at the level of the shoulders, hips, knees and ankles. Each strap is tied to its opposite beneath the trolley, whilst the arms are placed into six-foot sleeves, crossed and fastened beneath the trolley. The patient is thus firmly but not uncomfortably held. A special chin-strap made of soft leather passes over the head to prevent dislocation of the jaw. It has an ordinary buckle, but without a fastener, and is steadied during the convulsion by holding that portion of the strap which passes through the buckle. The sides of this chin-strap are made of " artificial limb " elastic, which permits of some movement of the temporo-mandibular joint, but prevents excess. When the patient is in position the current is passed.

Other workers either use manual restraint or merely support the limbs, but the above method justifies itself, as the only accidents to be noted are the loss of three

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loose teeth and a bruised hand; about 900 convulsions have been given in this series alone. No fractures have occurred. The method is exceptionally quick, and the average time taken for each patient from the moment of her getting on to the trolley to being placed in bed is less than two and a half minutes. This means that ten cases are dealt with in 25 minutes at each session, and on each occasion the whole affair occurs within the well-known post-convulsive retrograde amnesic phase.

Results.

In assessing the results of this treatment a difficulty at once arises as to how the cases shall be classified. So much debate has taken place about the validity of any classification that it might almost be disregarded altogether. The type adopted here follows that of the usual clinical groups, but a note as to definition is perhaps not out of place. Before this, however, we will examine the results as a whole and then subdivide them into their various groups. Our aims will be not simply to know the percentages of successes or failures, but to endeavour to extract from the results the reasons for these figures. It is to this end that some sort of clinical classification is necessary.

Table I.

Total number of cases . .	100
Success percentage . .	87 per cent.
Failure percentage . .	13 ,, including one death and two cases still having treatment.

The two noted as still undergoing treatment are put in the failure column so that no bias in favour of this therapy shall arise. Success in this table means that the depression and accompanying symptoms have disappeared. It is not judged by the discharge of the patient from hospital, because present conditions so often have disintegrated home life that even on recovery it has not always been possible for the patient to return to her former environment or a new one found for her, but it may at once be said that no less than 74 per cent. of the total have left hospital to resume their usual existence. This figure of successes agrees with Gonda, and is better than the favourable report by Hauser and Barbato. Sogliani had an 81 per cent. recovery-rate, and Myerson gives it as 88·8 per cent., but he only had 24 cases.

Classification.

The simpler this is the easier it is to see the results and so the following has been adopted:

(a) *First attack.*

This refers to those whose illness has been preceded by no other psychotic episode, and which on clinical grounds have not been put into section (d).

(b) *Recurrent cases.*

In this are included all cases known to have had a previous depressive illness, irrespective of their present age or symptomatology.

(c) *Manic-depressive group.*

Here are put only those known to have had at least one former manic illness.

(d) *Menopausal type.*

This has been based on an illness occurring at the menopausal period and with the usually accepted symptomatology. They are essentially first attacks.

(e) *The senile class.*

This has been limited to people of 60 or over and includes a mixture from the other groups. They have been separated off because the question of age and cardiovascular lesions in electric convulsion therapy has been raised and requires special reference.

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A. *First attacks.*

TABLE II.

Total number of cases	28
Success percentage	96·5 per cent.
Failure percentage	3·5 ,,
Average number of induced fits	6

It is not surprising that a high recovery-rate should be found in this type of case, since even without the treatment under discussion they do well. But it is interesting to note that the average length of stay in hospital following the last induced convulsion is only 4·4 weeks. This may well be compared or rather contrasted with the duration of hospital stay before this treatment was used. It will be seen that the total stay in hospital of this group including their treatment time is approximately eight weeks. The average stay of nearly 200 recovered cases prior to this treatment was 40 weeks, and St. Ebba's Hospital was admitting the same type of patient during each period. If the maintenance-rate be taken as 30 shillings a week it will at once be evident that there is a financial saving of about £45 per patient.

B. *Recurrent cases.*

TABLE III.

Total number of cases	49
Success percentage	87·8 per cent.
Failure percentage	12·2 ,,
Average number of induced fits	8

Again the average stay in hospital after the last treatment is four weeks, but again this class tends to do well at all times.

C. *Manic-depressive group.*

The manic-depressive psychosis as defined above is not so common as the text-books would have us believe, and it is not surprising that the figures are small.

TABLE IV.

Total number of cases	5
Success percentage	40 per cent.
Failure percentage	40 ,,
Deaths	20 ,,

The number is obviously too small for any reasonable deduction to be made, but the lack of success may be remarked *en passant*. The death in this table will be noted at greater length later.

D. *Menopausal type.*

TABLE V.

Total number of cases	18
Success percentage	88·9 per cent.
Failure percentage	11·1 ,,
Average number of induced fits	9

The average duration of their hospital stay after the last treatment is 2·5 weeks. When it is realized that this type of incapacity has, in the past, often been measured in years, the significance of this treatment becomes all the greater. We can now review the last group.

E. *Senile group.*

TABLE VI.

Total number of cases	9
Success percentage	88·9 per cent.
Failure percentage	11·1 ,,
Average number of induced fits	6

This type differs from the others in that the time of the hospital stay after the last treatment is rather longer than in the other groups, i.e. six weeks. This is

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probably accounted for by the sociological factors that we have already referred to. From time to time cases have arrived at this hospital with the considered opinion that their age or frailty render them unsuitable for the more drastic forms of therapy. Impastato and Almansi, for instance, rejected people over 50. The above table shows that this is wrong, for they react as satisfactorily as any other type, and it is not in this group that any of the mild accidents previously noted occurred. This is true, not only from the purely physical side of the question, but also from the point of view of their illness. It surely shows that arteriosclerosis is no adverse factor in prognosis, for this type gives as good results as depressions as a whole; and they do not require more fits than others, in fact rather less than the menopausal group.

Age alone, however, may not be so important as the blood pressure during the convulsion. When this is raised—and, as is well known, it rises even higher during the muscular paroxysms, as has been noted by Hemphill and Walter, Gonda and Sogliani—it might be thought that there was a grave risk of an intracranial or other catastrophe. Amongst the 100 cases here there are six with a systolic pressure of over 200 or a diastolic of over 100. Five belong to the recurrent type and one to the menopausal. All have responded satisfactorily to therapy and are considered recovered. The average number of fits required to obtain this was six, but one with a blood pressure of 190/110 had twelve, and another with a reading of 210/105 needed ten. In the light of this it must be doubted that hypertension is a contra-indication to treatment. It may, however, be argued that, if these cases were all essential hypertensives and non-symptom-producing, the raised blood pressure was having no great physical effect, and so was not of great importance. The following example seems to dispose of this, since it is one in which the hyperpiesia was producing its own symptoms and signs apart from those of the psychosis proper. It is worth a short record by itself.

F. G—, aged 55; widow. Admitted September 12, 1942.

Diagnosis.—Recurrent depression + hypertension.

History.—Suffered from hypertension for an indefinite period. 1935: A short depressive illness.

Condition on examination.—Physically: Heart—slight enlargement to left; apex beat thrusting; aortic second sound sharp and high pitched. B.P. 190/90. Fundi—blurred disc edges but no marked arterial changes.

Mentally: Depressed and overconcerned with her physical state. Mild agitation and loss of interests. These symptoms are of about two years' duration.

Course.—After 17 weeks' rest in hospital no improvement was seen. Both relatives and patient begged for electric convulsion therapy, although the risks were fully explained. B.P. at commencement of therapy 230/110. Six fits were given and the patient's depressive symptoms disappeared.

The only further point to note is that after one seizure she developed a bruise of one hand. It is no doubt true to say that it was fortunate a vessel in the hand and not the brain gave way, but without treatment she was probably due for an illness of prolonged duration at the best.

These few cases might reasonably be taken to show that the rise in the blood pressure during the convulsion is not so serious a hazard as might be supposed, and this conclusion is supported by the experimental work of Cleckley, Hamilton, Woodbury and Volpito, who showed that not only was there a rise in the blood pressure during metrazol convulsions, but also a rise in the intragastric pressure which was transmitted to the cerebro-spinal fluid. Since these two are the same there is no increased stress on the cerebral arterial tree, but in the case of the electric convulsion these two figures are not so approximate for the blood pressure exceeds the intragastric pressure, the difference being a measure of the added strain placed on the vascular system during the paroxysm, and this cannot be judged by the rise in blood pressure alone. It may be as well at this stage to refer to the one death that has occurred. Whether this death was directly attributable to treatment or not cannot be decided, but it certainly happened shortly after one such session. There is no proof of a relationship of cause and effect between treatment and death, but on the other hand there is no proof to the contrary. An open mind must be kept until further evidence comes to hand. An outline of the cases is now given:

N. C—, aged 54. Admitted 12.x.39.

Diagnosis.—Manic-depressive psychosis.

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Condition on examination.—Typically manic.

Course.—26.i.41: Arrangements made for her to go to an after-care home, but cancelled as depressive symptoms were coming on.

April, 1942: Electrically-induced convulsions started. Only two fits given, the latter on 22.iv.42. B.P. 180/85 at this time.

28.iv.42: Complained of feeling unwell. Temperature 102°.

29.iv.42: Signs of pneumonic consolidation at the right pulmonary base.

1.v.42: Acutely ill and delirious in spite of sulphapyridine. Urine unobtainable.

2.v.42: Urine showed albumen ++ and granular casts +++. Died this day.

Post-mortem.—Broncho-pneumonia and chronic nephritis.

This patient was apparently in good health prior to her final illness, in which the pneumonia seems to be the last phase of a uraemic episode. The question is, could this have been avoided if therapy had been withheld? It is impossible to answer this, and it is probably best simply to consider it as an associated death rather than anything more definite as yet.

Failures.

So far we have reviewed the cases mainly from the success point of view if we exclude the death just mentioned. We can now turn to the failures. These may be classified as partial and total. The latter term is self-explanatory; under the former are put all those which require a further course of treatment after apparent recovery. Maintenance doses, which are an accepted part of this therapy, vary from one or two convulsions to a second complete series of seizures. All examples must be included, because it is patently foolish to give any patient further fits unless some degree of relapse is present, and electricity cannot be used prophylactically because we can never foretell what the interval between any two attacks may be. The following table shows a summary of these:

TABLE VII.

Case.	Type.	A.	a.	B.	b.	C.	c.	D.	d.	E.	e.	F.	f.	Result.
1. A. A—	M.	4	8	4	1	16	1	..	..	..	..	..	..	*
2. L. C—	R.	20	11	26	1	..	..	..	..	..	..	..	..	*
3. R.G—	M.	80	8	6	3	9	5	..	..	..	..	..	..	†
4. E. G—	F.	4	7	1	1	..	..	..	..	..	..	..	..	*
5. Ev. G—	R.	26	3	1	3	6	2	..	..	..	..	..	..	*
6. B. B—	F.	20	10	4	7	3	6	..	..	..	..	..	..	*
7. L. H—	M.	24	7	21	2	..	..	..	..	..	..	..	..	*
8. B. H—	F.	100	5	1	8	..	..	..	..	..	..	..	..	*
9. E. M—	R.	20	5	3	2	7	2	5	1	..	..	..	..	*
10. E. S—	R.	20	9	3	7	3	4	4	5	2	6	2	4	†
11. D. W—	R.	12	5	2	4	5	2	3	2	5	2	..	..	†
12. A. M—	M-D.	16	7	14	2	18	4	..	..	..	..	..	..	*
13. R. H—	R.	5	8	23	2	..	..	..	..	..	..	..	..	*

M. = Menopausal.
R. = Recurrent.
F. = First.
M-D. = Manic-depressive.
* = Recovery.
† = Failure.

A = Time in weeks from onset of original illness to first treatment.
Other capitals = Time in weeks from previous treatment to relapse.
a, b, c, etc. = Number of fits given on each occasion to produce a remission.

The main points of interest brought out in this survey are:

i. The relapse-rate for all cases is 13 per cent.

ii. In this classification there occur six recurrent cases, three menopausals, three first attack type, and one manic-depressive.

iii. This group shows a comparatively high percentage of failures, i.e. three cases, whereas there are only 13 in the complete series.

iv. The severity of the relapse is shown by the number of fits necessary to overcome it. Usually this is less than for the original attack, but sometimes a second relapse needs more treatment than the first.

v. The interval between the original illness and the first relapse is usually short. In four cases only is this interval a fairly long one, i.e., 26, 21, 14, and 23 weeks; the three longest might even be considered as second attacks rather than relapses.

vi. One relapse only in five cases.

vii. Two relapses only in five cases.

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viii. Three relapses only in one case.
ix. Four relapses only in one case.
x. Five relapses only in one case.

These relapse cases taken in conjunction with those that failed to respond at all to treatment may be put together to illustrate what might be called the electrically resistant depressions; ultimate recovery does occur in some, however. Another type of resistance is also encountered which has nothing to do with the psychosis at all, but is physical in origin.

Physical Resistance in Electric Therapy.

In this type of person the psychosis may react in the usual way to the induced fit and excellent recovery result, but the resistance is shown by the difficulty encountered in producing a fit at all. When the current is passed it is the normal course for the convulsion to follow almost immediately. Most workers will have encountered the case that requires the passage of the current twice or perhaps three times before a seizure appears. These are the slightest and commonest examples of exaggerated physical resistance. At the other end of the scale is the individual who needs many more attempts before success is reached. The résumé of one patient's treatment set out below illustrates this. That it is an extreme and rare happening will not be doubted, and it might be thought that the fault was not in the patient but in some item of the technique. Against this is the fact that all others treated on the same days and in the same way behaved normally, and it will be noted that on no occasion was a fit readily produced in this person. It would seem improbable that the same error could recur each time she was due for treatment. There was no physical abnormality to account for it and she eventually left hospital recovered. No explanation can be offered.

B. B—, aged 53. An extremely agitated melancholic.

Date of treatment.	Number of times current was passed before a fit resulted.
10.xi.42	6
14.xi.42	26
17.xi.42	7
20.xi.42	18
24.xi.42	9
28.xi.42	5
1.xii.42	7
5.xii.42	11
8.xii.42	5
12.xii.42	10
15.xii.42	10

It may be repeated that the method described under that heading was adopted throughout this case; the voltage or the time was increased after each attempt until a seizure was obtained. That this case also demonstrates the safety of this treatment is self-evident.

Prognosis.

When we note that almost 90 per cent. of all depressions react favourably to electrically induced convulsions, it follows that the surest way of making a prognosis is to wait and see how any particular case is responding. This will of course become clear after the first few fits. The only other factor to be considered is that 13 per cent. of all cases relapse. It might be thought that some help could be obtained from the symptomatology, but a careful examination of those that cleared after a few fits—four being taken as the criterion—and those that needed a larger number revealed no particular that is found constantly in one lot or the other. The time factor, i.e. the duration of the illness before treatment, is interesting, and in the next table are put 13 cases in which symptoms were present for two or more years before treatment was started. The longer of these were already in hospital before this therapy was instituted.

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TABLE VIII.

Name.	Age.	Type.	Duration before treatment (in weeks).	Number of fits.	Result.
1. H. B—	46	F	260	9	*
2. F. G—	56	R.	121	6	*
3. J. H—	47	F.	130	8	*
4. A. H—	37	R.	440	9	†
5. F. H—	58	M.	208	2	*
6. E. K—	31	R.	156	10	†
7. A. P—	42	R.	336	7	*
8. W. P—	39	R.	104	7	*
9. L. R—	59	R.	105	6	*
10. E. S—	58	M-D.	250	17	†
11. E. U—	47	M-D.	104	13	*
12. M. W—	52	R.	304	10	*
13. A. W—	63	M-D.	136	10	*

Symbols are the same as those in Table VII.

It will be seen that 10 of the 13 have recovered. The only other important point to note is that the average number of fits needed is higher than in the other depressions, although in this selection it is only 9. It can be concluded that chronicity by itself does not preclude a patient from recovery. This constitutes one of the great advantages of this therapy.

MODUS OPERANDI OF THE TREATMENT.

We may now turn our attention to the most difficult part of all. There is no known explanation of how electricity brings about its results. It may be advantageous to review the more recent theories that have been put forward. First there is the suggestion of Fetterman that depression is a downward course in the mood with an inherent tendency to reverse itself after a varying interval. The unconscious phase of the treatment is supposed to bring about this reversal and so hasten recovery. Flescher, on the other hand, attributes the resulting success to the seizure itself and not to the loss of consciousness. He thinks that it is a means of unloading the huge amounts of energy that the depressive directs to death and destructive drives in an individually and socially harmless manner.

In opposition to these psychological interpretations we find that there are various physiological details which are not explained by the above. Grinker states that in metrazol convulsions the diencephalon is exploded, basing this idea upon the fact that the amnesia that follows the convulsion may be considered as a disruption of association pathways. An amnesia also follows electrically induced fits. Apart from these hypotheses it might not be out of place to look at some of the changes that can be observed during the treatment. Undoubtedly the most dramatic of these is the fit, but besides we also find (*a*) marked dilatation of the capillaries which is most readily seen on the face because this is the region where they are most profuse, and this is not limited to the area covered by the electrodes alone. Milch reports the same phenomenon in the retinal vessels, but they go into a state of contraction later; (*b*) dilatation of the pupils at the beginning of the effect—Gonda refers to this, and it can be easily seen by overcoming the spasm of the lids, but it quickly disappears; (*c*) salivation, which is most marked when the current is passed more than once; (*d*) slowing of the heart rate; Hemphill and Walter have drawn attention to this. Rhythm abnormalities have also been described as in the article by Bellet, Kerschbaum and Furst, whilst Wender and Jezer showed that in the case of metrazol all the cardiac arrhythmias fell into the increased vagal influence type.

It will be seen that all the above factors are due to stimulation of the parasympathetic nervous system and they are fairly constantly observed. Can this vagal stimulation be the cause of the improvement? It is an attractive theory, but it must be admitted that confirmation is lacking, and it is not logical to infer that because signs of vagal stimulation accompany the treatment these necessarily account for its success. Although further research is necessary it is as satisfactory a suggestion as any of the preceding ones.

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Histological Changes after Electric Therapy.

Finally we must examine the reports of the histologists on the changes following this treatment as seen in the experimental animal. Impastato and Almansi quote Cerletti as saying that the experimental dog shows an acute cell reaction without grave irreversible changes, whereas Bini found acute injury to the nerve cell of a reversible and irreversible type. There was retraction and hyperchromatosis of the cytoplasm and nucleus, with staining and tortuosity of the cell processes, i.e. " chronic cell disease " in the deeper layers of the cerebral cortex. More recently Alpers and Hughes examined the brains of 30 cats after shock had been given. Fourteen of these showed subarachnoid haemorrhages, usually mild, but sometimes more extensive in type; others showed haemorrhages in the cortex, white matter, cerebellum and third ventricle region usually punctate in size. And lastly Neubuerger, Whitehead, Rutledge and Ebaugh studied the results with twelve dogs. Their remarks are interesting in that they found the lesions were more numerous in the pathway of the current and greater in the cortex than the underlying grey matter. The cells revealed tigrolysis, paleness, swelling and vacuolation with a slight glial proliferation. Vascular dilatation and minute haemorrhages were seen in the cortex, meninges and around the ventricles. They thought that these changes were definite but not serious, and were due partly to the effect on the brain and partly to the effect on the vessels. It was also said that the changes were less than had been seen in similar metrazol cases. Other organs of the body were congested.

Summary.

1. A method for the administration of electrically-induced convulsions has been described, especially with reference to speed and safety.
2. The results in 100 depressive psychoses have been examined and classified.
3. The relation of this therapy to age and blood pressure has been discussed.
4. Factors influencing prognosis have been outlined, particularly the question of chronicity.
5. The relapse-rate and failures have been considered.
6. A physically resistant type has been noted.
7. Recent theories of the *modus operandi* have been examined, with references to some physiological changes.
8. A *précis* of the known histological changes is appended.

I have to thank Dr. Wootton for permission to use this material.

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USE OF A MODIFIED TAKATA REACTION IN THE EXAMINATION OF THE CEREBROSPINAL FLUID OF CERTAIN PSYCHOSES.

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THE Takata reaction has hitherto been mainly applied as a serum protein test and has been claimed useful in the diagnosis of liver disease.

It has been modified and applied to the cerebrospinal fluid (Takata-Ara (1)). Preliminary investigators found positive results in syphilis of the central nervous system, and it was thought to be a characteristic of this condition. Subsequent workers, however, found that organic conditions other than neuro-syphilis produced similar positive reactions, with the result that the test fell somewhat into disrepute. Now, however, it seems to be established that the test is indicative of a change in the albumin-globulin (euglobulin) ratios in the cerebrospinal fluid. This condition is mainly found in syphilis of the central nervous system, but occurs, of course, in other conditions affecting the central nervous system, especially where degenerative processes are involved.

In 1938 the author (2), described the use of a modified Takata reaction in testing the cerebrospinal fluid of cases of organic psychoses, mainly dementia paralytica. That preliminary investigation apparently confirmed the hypothesis that the Takata reaction arises from a disturbance of the albumin-globulin ratio of the cerebrospinal fluid.

The present paper illustrates an endeavour to obtain diagnostic criteria from the application of the modified reaction to specimens of cerebrospinal fluid taken from more varied clinical material. Of the cases examined one half suffered from neuroses or psychoses of types which are not generally considered to be connected with organic processes in the brain. The high degree of sensitivity of the Takata reaction was thought to be of use in detecting minute changes in the protein composition of the cerebrospinal fluid.

TECHNIQUE.

One would naturally expect that cerebrospinal fluid taken from such " non-organic " cases would have a small total protein content, and the estimation would call for a greater degree of accuracy than were the test to be applied to cases of the organic type such as described in the first paper. In the first paper attention was focussed on the time factor in performing the test. In this series still greater attention was paid to this point. A somewhat different method of reading the results was formulated and the appearance of the turbidity was listed in the following categories :

(*a*). Any turbidity appearing within the first 8 minutes of the test.
(*b*) Any turbidity appearing after a lapse of 8 minutes.
(*c*) Definite turbidity making its appearance after a lapse of 30 minutes.

It was noted that even slight variations in temperature had a marked effect on the time of appearance of turbidity. A constant temperature of 15° C. will be found to be the optimum for the conditions described in this paper. Failing these conditions, allowances with regard to the time factor have to be made. For example an increase in the temperature of 10° C. above the " optimum " will reduce the reaction time to a very considerable extent.

REAGENTS.

1. 0·36 per cent. aqueous solution of anhydrous sodium carbonate.
2. 0·5 per cent. aqueous solution of mercuric chloride.

In the original paper it was stressed that the reagents were satisfactory if equal volumes of the reagents gave a faint pink colour on the addition of phenolphthalein.

* With the technical collaboration of R. F. Lane, Senior Laboratory Technician, Shenley Hospital.

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It is now preferred to add 0·1 c.c. of each of the reagents to 1 c.c. of distilled water and then add one drop of phenolphthalein. By this method the precipitation of a double salt is avoided—a condition which arose when the former method of testing the reagents was employed.

TEST.

To 1 c.c. of fresh cerebrospinal fluid add 0·1 c.c. of the sodium carbonate solution. Mix well and add 0·1 c.c. of the mercuric chloride solution and again mix well and allow to stand.

READING.

1. The tube is inspected at frequent intervals during the first 8 minutes, the appearance of any turbidity being noted.

2. Readings are then made at intervals of 5 minutes until 30 minutes have elapsed.

In the majority of cases the turbidity will commence during the first few minutes, but in others the reaction will not occur until later. The turbidity may or may not increase as time elapses and the time of the first appearance of turbidity should be noted. Any turbidity occurring after the first 8 minutes was prefixed by the word " late." The degree of turbidity at the end of 30 minutes was noted as the result.

Hence the 30-minute reading made in a reaction which commences during the first 8 minutes will be :

Strong positive (++), positive (+), weak positive (W+), Trace (Tr.), or Faint Trace (F.Tr.), and ± (doubtful).

But in a case where the reaction does not commence during the first 8 minutes it will be :

Late strong positive (L.++), late positive (L.+), etc.

3. Very occasionally a definite reaction will commence after 30 minutes, and all tubes which give a negative reading at the end of 30 minutes should be allowed to stand until 90 minutes have elapsed to exclude these very late positive results.

Daylight was used for reading and the turbidity made evident by holding the tube against a dark background in front of a window. In very dull daylight readings were made by holding the tube in the light from a microscope lamp against a dark background, although this method tends to magnify the strength of the reaction.

As might be expected, many cases in the series might yield only very weak results, and to render the results impartial at least two observers and sometimes three or four have read the tubes independently, and completely unaware of the clinical diagnosis.

Cerebrospinal fluid is usually collected in two or more portions, and the fluid taken for the reaction was wherever possible taken from the second fraction to avoid admixture with blood. In every case the following was also adopted as the routine examination :

1. *Cells.*—A Fuchs-Rosenthal chamber was used and 3 cmm. were counted, the result being expressed as Cells/3. Fluids containing over 1500/3 red cells were omitted. Fluids containing more than 200/3 red cells have been marked in the tables.

2. *Pandy.*—Six drops of a saturated aqueous solution of phenol were placed in a watch glass and one drop of fluid was allowed to run down the glass and into the phenol. The glass was not agitated and no significance was attached to a reaction occurring after 10 seconds.

3. *Nonne.*—The " ring test " modification was used. 0·5 c.c. of fluid was placed in a test tube, and with the tube at an angle, 0·5 c.c. of saturated ammonium sulphate solution was allowed to run down the tube and through the fluid. The reaction should not be read before 3 minutes. Reactions occurring after 10 minutes were called " late," and discarded when they occurred later than 20 minutes. The result of the reaction was read with the help of a hand lens.

4. *Wassermann and Meinicke.*

5. Lange and total protein estimations have been carried out in a number

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of cases (one of the usual turbidometric methods being used for the protein estimation). As it is known that these tests do not assist in the diagnosis of non-organic psychoses, the results have been omitted.

Case Material and Results.

1. Syphilis and neuro-syphilis (25 cases).
2. Non-psychotic organic neurological cases (24 cases).
3. Psychoses due to senile dementia, arteriosclerosis, and other more generalized organic conditions (12 cases).
4. Involutional psychoses (10 cases).
5. Hysteria and neurotic conditions (7 cases).
6. Manic and depressive states (8 cases).
7. Schizophrenia (53 cases).
8. Schizophrenic states superimposed on cerebral disease (7 cases).
9. Atypical psychoses (14 cases).
10. Psychoses with disputed diagnoses (5 cases).

1. *Syphilis and Neuro-syphilis.*

The results were in conformity with those published in the previous paper. It is of interest to note that in some cases of congenital syphilis the Takata reaction was weakly positive with the other reactions being negative. In some cases the clinical diagnosis could not be confirmed by any of the reactions, including Wassermann and Lange.

2. *Non-psychotic Organic Neurological Cases.*

Among these a great variety of different organic disorders of the nervous system were present. In 10 of these cases all three reactions were positive, although to varying degrees. In 1 case a late weak positive Takata was present with a doubtful Pandy reaction. In 6 cases a weak positive Takata reaction occurred with doubtful or very weak Nonne reactions. In 7 cases the Takata reaction varied from faint trace to weak positive, the Pandy and Nonne reactions being negative. These cases were (*a*) post-traumatic condition, (*b*) recovering cerebrospinal meningitis, (*c*) hemiplegia of long standing, (*d*) encephalitis following vaccination, (*e*) case of epilepsy, (*f*) suspected brain tumour, (*g*) case of sciatica.

It is interesting to note that in one case of commencing cerebrospinal meningitis Pandy and Nonne reactions were strongly positive while the modified Takata reaction was very late positive.

In the following tables the abbreviations used are:

1. For reactions commencing during the first few minutes: ± (doubtful), F.Tr. (faint trace), Tr. (trace), W.+ (weak positive), + (positive), ++ (strong positive).

2. For reactions commencing after 8 minutes: L (late) prefixes the readings which are identical with those above.

3. *Psychoses due to Senile Dementia, Arteriosclerosis and other more generalized Organic Conditions.*

Pandy.	Nonne.	Takata.	Cases.	Clinical remarks, etc.
—	—	—	1	Schizoid psychosis. Pupils show no reaction to light. Babinski and other pyramidal symptoms positive. W.R. negative. Cells 12/3.
—	—	—	1	Froehlich syndrome.
—	—	±	1	Senile dementia.
—	—	L.Tr.	1	Korsakoff syndrome.
—	±	±	1	Senile dementia.
—	Tr.	±	1	Organic psychosis.
—	W.+	L.±	1	Puerperal psychosis.
±	Tr.	Tr.	1	Depressive psychosis plus pernicious anaemia.
Tr.	Tr.	L.Tr.	1	Hypovitaminosis.
Tr.	L.Tr.	L.Tr.	1	Arteriosclerosis.
W.+	Tr.	—	1	" Organic " psychosis.
Tr.	W.+	W.+	1	Arteriosclerotic dementia.
			Total, 12 cases.	

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In only two of these cases were all reactions negative. The case of Froehlich's syndrome did not show any sign of central nervous neurological disturbance. The other case had remained stationary for a considerable time. In the remainder of the cases the strength of the reactions ran almost parallel to the clinical condition.

4. *Involutional Psychoses.*

TABLE A.—*Cases not complicated by Organic Factors.*

Pandy.	Nonne.	Takata.	Cases.	Clinical remarks, etc.
—	—	—	1	Typical involutional melancholia, feelings of guilt, no projected delusions, hypertension.
—	—	L.±	1	Mild paranoid depressive delusions.

TABLE B.—*Cases complicated by Organic Factors.*

Pandy.	Nonne.	Takata.	Cases.	Clinical remarks, etc.
—	—	L.Tr.	1	Plus organic symptoms after electro-shock therapy.
—	L.Tr. or stronger	L± or stronger	3	Typical depression with feelings of guilt, but complicated by symptoms indicative of organic cerebral disorder.
—	±	+	1	Depressive paranoid delusions and hallucinations. Slight reflex differences.
—	Tr.	Tr.	1	Pyramidal signs due to arteriosclerosis cerebri.
—	±	L.+	1	Ditto.
±	—	Tr.	1	Plus mild organic dementia.

Total, 10 cases.

It appears to be significant that while in the two uncomplicated cases Nonne and Pandy were both negative, and in one case the Takata was late doubtful, the other being negative, the findings were different in the complicated cases. In the cases complicated by organic factors, the Takata results, with one exception, were accompanied by positive Nonne or Pandy reactions in varying degrees of positivity.

5. *Hysteria and Neurotic Conditions.*

Pandy,	Nonne.	Takata.	Cases.	Clinical remarks, etc.
—	—	—	4	Hysteria.
—	—	L.±	1	Schizoid personality.
—	—	L.F.Tr.	1	Severe conversion hysteria with strong tremor of seven years' standing.
—	±	—	1	Hysteria superimposed on slight cerebral disorder. Cells 9/3.

Total, 7 cases. Average cell count 1/3, if last case is omitted.

The organic component in the last case is expressed by the doubtful Nonne reaction and an increased cell count. The very low average cell count (1/3), if the organic case is omitted, is remarkable. An evaluation of the very weak and late Takata reactions in cases with very severe neuroses of long standing will not be possible until more material is available.

6. *Manic and Depressive States.*

Pandy.	Nonne.	Takata.	Cases.	Clinical remarks, etc.
—	—	—	6	—
—	—	L.±	1	Old head injury.
—	—	L.Tr.	1	Pyramidal disturbances caused by electro-shock therapy (?).

Total, 8 cases. Average cell count 2·5/3.

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This group showed entirely negative results in six cases, a "late doubtful" and "late trace" reaction in two cases, both complicated by organic features. The average cell count was 2·5/3. One of the "negative" cases, which appeared to be typically manic when the cerebrospinal fluid was examined, developed a "toxic" psychosis later on. Two more of these negative cases had suffered severe head injuries one and two years respectively before the outbreak of the psychosis.

7. *Schizophrenia.*

TABLE A.—*Typical Clinical Cases with "Characteristic" Reactions in the Cerebrospinal Fluid.*

Pandy.	Nonne.	Takata.	Cases.	Clinical remarks, etc.
—	—	Tr. or W.+	28	Two acute cases with 15/3 and 8/3 cells respectively and two cases with about 1500/3 red cells.
—	±	Do.	11	—
±	—	,,	3	—
±	±	,,	7	Including 2 cases with 900/3 and 1500/3 red cells respectively.

Total, 49 cases. Average cell count 5/3.

TABLE B.—*Cases with Less Characteristic Reactions.*

Pandy.	Nonne.	Takata.	Cases.	Clinical remarks, etc.
—	—	—	1	Typical schizophrenic behaviour, but without paralogia and psycho-motor symptoms. Some manic-depressive features. Heredity: Mother, melancholia; sister, epilepsy and mental deficiency.
—	—	L.±	1	Recovering after electro-shock therapy.
—	±	F.Tr.	1	Beginning schizophrenia.
±	Tr.	W.+	1	Schizophrenia with long-standing hypertension.

Total, 4 cases. Average cell count 5/3.

The cases in Table A are apparently characterized by "trace" or "weak positive" Takata reactions, the other reactions being negative or doubtful.

In Table B the reactions were different from those of Table A, the Takata reaction being either negative or weaker or "late" or connected with a slightly stronger Nonne.

8. *Schizophrenic States Superimposed on Cerebral Disease.*

Pandy.	Nonne.	Takata.	Cases.	Clinical remarks, etc.
—	—	Tr. or stronger	3	1 chorea, 1 mental deficient, 1 chronic alcoholism.
—	—	L.Tr.	1	Pernicious anaemia.
—	±	F.Tr.	1	Mental deficient.
—	W.+	+	1	"Organic" disease of the brain.
+	+	++	1	Hereditary paraplegia.

Total, 7 cases. Average cell count 5/3.

Three cases in this group showed "characteristic" reactions whilst the reactions of the other cases differed. Although the average cell count was 5/3, it should be mentioned that it was 11/3 in the case of chorea, 10/3 in a case superimposed on mental deficiency, and only 1/3 in the case of hereditary paraplegia.

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9. *"Atypical" Psychoses.*

Pandy.	Nonne.	Takata.	Cases.	Clinical remarks, etc.
—	—	—	1	See discussion.
—	—	L. ± to W.+	10	
—	F.Tr.	L.Tr.	1	
—	±	W.+	1	
±	—	L.Tr.	1	

Total, 14 cases. Average cell count 9/3.

It is remarkable to note that in these cases the Takata reaction was "late" in 12 out of 14 cases, Pandy and Nonne being negative in 11 cases and the average cell count being slightly but definitely increased.

10. *Cases with Disputed Diagnoses.*

Pandy.	Nonne.	Takata.	Cases.	Clinical remarks, etc.
—	—	F.Tr.	1	Paranoid dementia ?. Involutional psychoses with depressive paranoid delusions and auditory hallucinations.
—	—	W.+	1	Paranoid dementia ?. Auditory hallucinations in beginning organic dementia.
—	—	W.+	1	Paranoid schizophrenia ?. Recurrent mania with paranoid features. Slight disturbance of thought and scanty psycho-motor symptoms.
—	±	Tr.	1	Paranoid schizophrenia ?. Atypical mania ?.
—	L.Tr.	+	1	Paranoid schizophrenia ?. Alcohol hallucinosis.

Total, 5 cases. Average cell count 4/3.

In three of these cases the reactions were characteristic. In one of the other two cases (involutional psychosis) the Takata reaction was weaker than is usually found in schizophrenia and this may be in favour of the diagnosis of involutional psychosis. In the other case the diagnosis of alcohol hallucinosis may be supported by a relatively strong Nonne and strong positive Takata reaction.

Discussion.

The material presented here and the results obtained on 165 cerebrospinal fluids can be divided into three groups:

1. *Organic Neurological Cases and Syphilitic Conditions including G.P.I.*

The fluids of these 49 cases were usually characterized by some positivity of all three protein reactions. The results of the first communication are confirmed, "that the modified Takata reaction is superior to the Pandy test usually made in the routine examination of cerebrospinal fluid," and the present series also shows that it is superior to the Nonne test. Again, in a number of organic neurological cases, the modified Takata reaction was the only reaction indicating some disturbance in the protein composition of the cerebrospinal fluid. Sometimes, however, the Pandy and Nonne tests were stronger than the modified Takata reaction—a state which may have been due to an absolute or relative increase in the "albumin" fraction. This was clearly demonstrated in the case of commencing cerebrospinal meningitis, where Nonne and Pandy reactions were much stronger than the very late positive modified Takata reaction. Otherwise the Nonne test was positive 30 times in these cases, while Pandy was positive in 23 cases only.

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2. *" Organic " Psychoses.*

The group of so-called " organic " psychoses and psychoses with organic complications showed characteristics similar to those of the organic neurological group, although on the whole the reactions were less strong. Again, the Nonne test was more frequently positive than the Pandy, as was demonstrated in the group of " complicated " involutional psychoses. The Nonne gave a positive result in six cases against one positive Pandy reaction. The negative results of all three protein reactions in a case of very typical involutional depression and the late doubtful result of the modified Takata reaction in a case of mild paranoid depressive delusions seem to be in agreement with the results described below on the group of emotional psychoses. On the other hand, not too much attention should be paid to the results obtained in two cases only. Broadly speaking, there appear to be slight pathological changes in the cerebrospinal fluid of quite a number of so-called involutional melancholias—a fact which is borne out by the clinical picture, namely, in some of these cases, slight organic neurological symptoms were confirmed by weak positive protein reactions, while in others, a second more careful clinical examination carried out after the results of the fluid examination had been obtained revealed the presence of mild organic neurological disorders.

3. *Non-organic Psychoses and Personality Disorders.*

The fluid findings in the groups of hysteric, neurotic and manic and depressive states were such as one might expect—negative or only doubtful reactions and a low cell count of 1/3 and 2·5/3 respectively, but the groups are small and moreover complicated by external factors in a few cases. This being so, it is deemed wiser not to discuss these groups at the present moment.

The reaction has also been carried out on 79 cases showing definite " schizophrenic " symptoms (49 typical schizophrenics, 4 schizophrenics showing some peculiarities with regard to the state of the disease or symptoms, 14 " atypical " cases, 5 cases with disputed diagnoses, and 7 cases of schizophrenia superimposed on other conditions). It appears justifiable to discuss them in some detail.

In the 49 typical cases the modified Takata reaction usually appeared in the first 3–5 minutes and the turbidity increased during the first 30 minutes to give a weak positive (varying from trace to weak positive). In 28 of these cases Nonne and Pandy tests were negative, and in 11 other cases the Nonne was doubtful and the Pandy negative. In a further 7 cases both Nonne and Pandy were doubtful and in 3 cases the Pandy reaction was doubtful with a negative Nonne reaction. The average cell count was 5/3. So it appears that with the absence of organic symptoms the reaction type of " weak positive modified Takata reaction together with negative or doubtful Nonne and/or Pandy reactions " is " characteristic " (although, of course, not " specific ") for clinically typical cases of schizophrenia. In another 4 cases which had to be considered as schizophrenia the protein reactions were not " characteristic." These cases showed some peculiarities with regard to their development, clinical state, etc., which may, but of course need not, explain this difference in reaction type. In 5 other cases the diagnosis was disputed, and 14 cases were considered to be " atypical," the latter ones showing such a mixture of manic-depressive and schizophrenic symptoms that it was felt that they fitted neither the diagnosis of schizophrenia nor manic-depressive psychosis. It has often been stated that one finds a relatively adequate emotional response in female schizophrenic patients which is likely to upset the diagnosis, but it can be stated that 10 of these 14 cases were male patients. Twelve out of these 14 were characterized by late modified Takata reactions. Only one of these cases showed a "characteristic " reaction with a cell count of 17/3, and this case had been diagnosed as " paranoid schizophrenia " elsewhere. Further examination of cases, " atypical " from either the clinical or laboratory point of view, similar to the 23 just mentioned, are most desirable for diagnostic and prognostic reasons (especially with regard to treatment).

Three of the cases of schizophrenia superimposed on other conditions also gave " characteristic " reaction types. Among the remainder of the 165 cases, only 11 showed reactions similar to the " characteristic " type. One of them, diagnosed as involutional melancholia, had auditory hallucinations and paranoid delusions. Three cases were of a neurological nature, epilepsy, old hemiplegia and sciatica,

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and 6 cases were suffering from syphilis. Cases of this latter type usually give rise to a disturbance of the albumin-" globulin " ratio of the cerebrospinal fluid.

The results obtained with the modified Takata reaction in combination with Nonne and Pandy reactions support the view that the changes found may be due to a change in the albumin-" globulin " ratio in the cerebrospinal fluid. The Nonne reaction, which is considered to be specific for " globulin," was positive in 75 cases, against a positive Pandy reaction occurring only in 43 cases in this series of 165 cases.

The results obtained in schizophrenics generally confirm the findings of Kafka and Samson (3), and Neel and his collaborators (4 and 5), using more complicated methods.

Summary.

A modified Takata reaction, together with the usual routine tests carried out on cerebro-spinal fluid, has been applied to the cerebrospinal fluids of organic and non-organic neurological and psychiatric cases.

The results of the gross organic neurological group confirmed previous observations on the value of the Takata reaction on cerebrospinal fluid.

In " organic " psychoses the modified Takata reaction is often weak positive in a number of cases, together with a slight Nonne and/or Pandy reaction.

The tests have also been used on nearly 80 cases of " non-organic " psychoses. If attention is paid to finer variations of the results, changes in the cell and protein content of the cerebrospinal fluid will be found in a surprisingly great number of " non-organic " psychiatric cases. These changes appeared to be most outspoken in the group of " schizophrenia." It appears to be characterized by a weak (trace to weak positive) Takata reaction, with the other tests negative or doubtful, aud an average cell count of 5/3.

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Part II.—Bibliography and Epitome.*

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1. Toxic delirious reactions in older people are quite common.

2. They probably can be prevented if the clinician will keep in mind the special factors in the handling of older people.

3. If a toxic delirious reaction does develop, it can be corrected by glucose infusion therapy. Simple elimination of the etiological factor will not correct delirious states in older people, as it does in younger people, in the great majority of cases. (Author's abstr.)

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Benzedrine is of great benefit in stimulating interest and drive in learning in the child with a learning disability, providing the original impulse has been obscured through the operation of neurotic mechanisms.

Fear, depression and sexual tension in the child are often completely relieved during the period of benzedrine administration, as is hyperkinesis occurring on a neurotic basis. Activity is frequently integrated and made more productive, and the relationship to the group is thus facilitated.

In the group studied benzedrine had no appreciable effect upon the behavior of children with developmental brain defects or with schizophrenia, and its effect upon the psychopathic personality was in all respects unfavourable. Consequently its use in a controlled ward set-up may be an aid in the differential diagnosis of some obscure problems. It has also clarified our concepts in regard to the classification of behavior problems in children as they are here described. However, it is worth emphasizing again that the successful use of this drug in the behavior problems of children depends on a clear understanding of the causes of the child's problems, the proper choice of children to receive the drug, and the use of the drug only as an adjunct to adequate personal psychotherapy, tutoring and social adjustments. (Authors' abstr.)

Fluctuations of Blood Iodine in Cyclic Psychoses.

1. As a group, manic patients have higher, and depressive patients have lower blood iodine levels than a group of normal controls.

2. In individual cases of true manic-depressive psychoses, a close correspondence between changes in mood and changes in blood iodine is found.

3. In contrast to these findings there is no coincidence between changes in mood or motor excitement and blood iodine in other psychotic states. (Authors' abstr.)

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9. *"Atypical" Psychoses.*

Pandy.	Nonne.	Takata.	Cases.	Clinical remarks, etc.
—	—	—	1	See discussion.
—	—	L. ± to W.+	10	
—	F.Tr.	L.Tr.	1	
—	±	W.+	1	
±	—	L.Tr.	1	

Total, 14 cases. Average cell count 9/3.

It is remarkable to note that in these cases the Takata reaction was "late" in 12 out of 14 cases, Pandy and Nonne being negative in 11 cases and the average cell count being slightly but definitely increased.

10. *Cases with Disputed Diagnoses.*

Pandy.	Nonne.	Takata.	Cases.	Clinical remarks, etc.
—	—	F.Tr.	1	Paranoid dementia ?. Involutional psychoses with depressive paranoid delusions and auditory hallucinations.
—	—	W.+	1	Paranoid dementia ?. Auditory hallucinations in beginning organic dementia.
—	—	W.+	1	Paranoid schizophrenia ?. Recurrent mania with paranoid features. Slight disturbance of thought and scanty psycho-motor symptoms.
—	±	Tr.	1	Paranoid schizophrenia ?. Atypical mania ?.
—	L.Tr.	+	1	Paranoid schizophrenia ?. Alcohol hallucinosis.

Total, 5 cases. Average cell count 4/3.

In three of these cases the reactions were characteristic. In one of the other two cases (involutional psychosis) the Takata reaction was weaker than is usually found in schizophrenia and this may be in favour of the diagnosis of involutional psychosis. In the other case the diagnosis of alcohol hallucinosis may be supported by a relatively strong Nonne and strong positive Takata reaction.

Discussion.

The material presented here and the results obtained on 165 cerebrospinal fluids can be divided into three groups:

1. *Organic Neurological Cases and Syphilitic Conditions including G.P.I.*

The fluids of these 49 cases were usually characterized by some positivity of all three protein reactions. The results of the first communication are confirmed, "that the modified Takata reaction is superior to the Pandy test usually made in the routine examination of cerebrospinal fluid," and the present series also shows that it is superior to the Nonne test. Again, in a number of organic neurological cases, the modified Takata reaction was the only reaction indicating some disturbance in the protein composition of the cerebrospinal fluid. Sometimes, however, the Pandy and Nonne tests were stronger than the modified Takata reaction—a state which may have been due to an absolute or relative increase in the "albumin" fraction. This was clearly demonstrated in the case of commencing cerebrospinal meningitis, where Nonne and Pandy reactions were much stronger than the very late positive modified Takata reaction. Otherwise the Nonne test was positive 30 times in these cases, while Pandy was positive in 23 cases only.

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2. *" Organic " Psychoses.*

The group of so-called " organic " psychoses and psychoses with organic complications showed characteristics similar to those of the organic neurological group, although on the whole the reactions were less strong. Again, the Nonne test was more frequently positive than the Pandy, as was demonstrated in the group of " complicated " involutional psychoses. The Nonne gave a positive result in six cases against one positive Pandy reaction. The negative results of all three protein reactions in a case of very typical involutional depression and the late doubtful result of the modified Takata reaction in a case of mild paranoid depressive delusions seem to be in agreement with the results described below on the group of emotional psychoses. On the other hand, not too much attention should be paid to the results obtained in two cases only. Broadly speaking, there appear to be slight pathological changes in the cerebrospinal fluid of quite a number of so-called involutional melancholias—a fact which is borne out by the clinical picture, namely, in some of these cases, slight organic neurological symptoms were confirmed by weak positive protein reactions, while in others, a second more careful clinical examination carried out after the results of the fluid examination had been obtained revealed the presence of mild organic neurological disorders.

3. *Non-organic Psychoses and Personality Disorders.*

The fluid findings in the groups of hysteric, neurotic and manic and depressive states were such as one might expect—negative or only doubtful reactions and a low cell count of 1/3 and 2·5/3 respectively, but the groups are small and moreover complicated by external factors in a few cases. This being so, it is deemed wiser not to discuss these groups at the present moment.

The reaction has also been carried out on 79 cases showing definite " schizophrenic " symptoms (49 typical schizophrenics, 4 schizophrenics showing some peculiarities with regard to the state of the disease or symptoms, 14 " atypical " cases, 5 cases with disputed diagnoses, and 7 cases of schizophrenia superimposed on other conditions). It appears justifiable to discuss them in some detail.

In the 49 typical cases the modified Takata reaction usually appeared in the first 3–5 minutes and the turbidity increased during the first 30 minutes to give a weak positive (varying from trace to weak positive). In 28 of these cases Nonne and Pandy tests were negative, and in 11 other cases the Nonne was doubtful and the Pandy negative. In a further 7 cases both Nonne and Pandy were doubtful and in 3 cases the Pandy reaction was doubtful with a negative Nonne reaction. The average cell count was 5/3. So it appears that with the absence of organic symptoms the reaction type of " weak positive modified Takata reaction together with negative or doubtful Nonne and/or Pandy reactions " is " characteristic " (although, of course, not " specific ") for clinically typical cases of schizophrenia. In another 4 cases which had to be considered as schizophrenia the protein reactions were not " characteristic." These cases showed some peculiarities with regard to their development, clinical state, etc., which may, but of course need not, explain this difference in reaction type. In 5 other cases the diagnosis was disputed, and 14 cases were considered to be " atypical," the latter ones showing such a mixture of manic-depressive and schizophrenic symptoms that it was felt that they fitted neither the diagnosis of schizophrenia nor manic-depressive psychosis. It has often been stated that one finds a relatively adequate emotional response in female schizophrenic patients which is likely to upset the diagnosis, but it can be stated that 10 of these 14 cases were male patients. Twelve out of these 14 were characterized by late modified Takata reactions. Only one of these cases showed a "characteristic " reaction with a cell count of 17/3, and this case had been diagnosed as " paranoid schizophrenia " elsewhere. Further examination of cases, " atypical " from either the clinical or laboratory point of view, similar to the 23 just mentioned, are most desirable for diagnostic and prognostic reasons (especially with regard to treatment).

Three of the cases of schizophrenia superimposed on other conditions also gave " characteristic " reaction types. Among the remainder of the 165 cases, only 11 showed reactions similar to the " characteristic " type. One of them, diagnosed as involutional melancholia, had auditory hallucinations and paranoid delusions. Three cases were of a neurological nature, epilepsy, old hemiplegia and sciatica,

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and 6 cases were suffering from syphilis. Cases of this latter type usually give rise to a disturbance of the albumin-" globulin " ratio of the cerebrospinal fluid.

The results obtained with the modified Takata reaction in combination with Nonne and Pandy reactions support the view that the changes found may be due to a change in the albumin-" globulin " ratio in the cerebrospinal fluid. The Nonne reaction, which is considered to be specific for " globulin," was positive in 75 cases, against a positive Pandy reaction occurring only in 43 cases in this series of 165 cases.

The results obtained in schizophrenics generally confirm the findings of Kafka and Samson (3), and Neel and his collaborators (4 and 5), using more complicated methods.

Summary.

A modified Takata reaction, together with the usual routine tests carried out on cerebro-spinal fluid, has been applied to the cerebrospinal fluids of organic and non-organic neurological and psychiatric cases.

The results of the gross organic neurological group confirmed previous observations on the value of the Takata reaction on cerebrospinal fluid.

In " organic " psychoses the modified Takata reaction is often weak positive in a number of cases, together with a slight Nonne and/or Pandy reaction.

The tests have also been used on nearly 80 cases of " non-organic " psychoses. If attention is paid to finer variations of the results, changes in the cell and protein content of the cerebrospinal fluid will be found in a surprisingly great number of " non-organic " psychiatric cases. These changes appeared to be most outspoken in the group of " schizophrenia." It appears to be characterized by a weak (trace to weak positive) Takata reaction, with the other tests negative or doubtful, aud an average cell count of 5/3.

Thanks are due to Dr. O. FitzGerald, Acting Medical Superintendent of this Hospital, for constructive criticism, to Major J. Niven, R.A.M.C., for the provision of most of the neurological material, and to Drs. D. Bardon and J. Faiq for providing many of the cerebro-spinal fluids from psychiatric cases and discussing clinical diagnosis.

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In the more severely neurotic child, benzedrine acts only as an expedient to help the child adjust in an environment where he can later find help for his deeper conflicts, and leads to an evasion of these problems during the period of administration. Here, too, the art and fantasy production show an inhibition which parallels the evasion noted in the personal therapeutic approach during medication.

Benzedrine is of great benefit in stimulating interest and drive in learning in the child with a learning disability, providing the original impulse has been obscured through the operation of neurotic mechanisms.

Fear, depression and sexual tension in the child are often completely relieved during the period of benzedrine administration, as is hyperkinesis occurring on a neurotic basis. Activity is frequently integrated and made more productive, and the relationship to the group is thus facilitated.

In the group studied benzedrine had no appreciable effect upon the behavior of children with developmental brain defects or with schizophrenia, and its effect upon the psychopathic personality was in all respects unfavourable. Consequently its use in a controlled ward set-up may be an aid in the differential diagnosis of some obscure problems. It has also clarified our concepts in regard to the classification of behavior problems in children as they are here described. However, it is worth emphasizing again that the successful use of this drug in the behavior problems of children depends on a clear understanding of the causes of the child's problems, the proper choice of children to receive the drug, and the use of the drug only as an adjunct to adequate personal psychotherapy, tutoring and social adjustments. (Authors' abstr.)

Fluctuations of Blood Iodine in Cyclic Psychoses.

1. As a group, manic patients have higher, and depressive patients have lower blood iodine levels than a group of normal controls.

2. In individual cases of true manic-depressive psychoses, a close correspondence between changes in mood and changes in blood iodine is found.

3. In contrast to these findings there is no coincidence between changes in mood or motor excitement and blood iodine in other psychotic states. (Authors' abstr.)

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Brain Injury, Drugs, and Environment as Causes of Mental Decay in Epilepsy.

This is the second of a series of three papers dealing with mental deterioration in epilepsy. Comparison was made of the mental state of 449 "symptomatic" and 1,456 "essential" epileptics. Twenty-six per cent. of the symptomatic and 10 per cent. of the essential group showed definite deterioration, although the former group had experienced fewer seizures. The elimination of patients who were mentally deficient at birth decreased the disparity to 12 and 6 per cent. respectively. With respect to the age of patients at the onset of seizures, serious deterioration was more manifest in the symptomatic group in all ages, but the difference was greatest if seizures began in adult life. With respect to the duration of epilepsy, again deterioration was more marked in the symptomatic group in all periods, but the difference was greatest if the epilepsy had just begun. In the symptomatic group deterioration was more often present before seizures began.

Patients whose mentality improved while using anticonvulsant drugs numbered for phenobarbital 30 per cent., for bromides 26 per cent., and for patent medicines 13 per cent. Improvement of seizures was noted, respectively, in 65, 53 and 40 per cent. of patients reporting the use of these drugs. (Author's abstr.)

Further Follow-up Results in Insulin-Shock Therapy.

The results of insulin-shock therapy, with an immediate recovery-rate of 55 per cent., show a tendency to level off at about 33 per cent. in the second, third and fourth years. (This tendency continues in the few cases which could be followed for five years.) With an immediate recovery-rate five times that of control cases in the Pennsylvania Hospital and with a long distance recovery-rate twice that of controls, the therapy seems justified.

Three cases died of insulin shock. In the other 185 cases there seem to be no signs of brain damage and no signs of mental deterioration greater than is found in schizophrenic patients not treated by shock. Eight recovered patients are doing their work with judgment and initiative five years after the termination of therapy. Two more made "spontaneous" recoveries some years after discharge from the hospital.

In all there are 7 deaths in the insulin-shock group of 188; in a control group of 116 patients there were 10 deaths. The control group was followed for a greater average number of years, but the deaths seem to be about in proportion to those of the insulin group.

The good results from insulin treatment were produced at once in about six weeks from the beginning of treatment. The good results in the control cases came in half the cases years after the admission to the hospital. In 13 of the cases recorded after the first year as unimproved, there were good remissions of at least one year (totalling 15 years) in which the patients supported themselves.

The difficulties in finding the prognosis in schizophrenia are well brought out in the papers of Romano and Ebaugh (2), Rupp and Fletcher (3), with their attached references.

The therapeutic activity which is involved in insulin shock with the remarkable immediate results visible to other patients and to nurses and physicians creates hope in patients, families of patients and staff. It opens a door for research into the psychological, cortical, metabolic nature of schizophrenia. (Authors' abstr.)

Comparative Study of the EEGs of Schizophrenic and Manic-Depressive Patients.

A comparative study of a group of EEGs of 126 schizophrenics and 81 manic-depressives revealed significant differences in the distribution of certain measurable factors. The distribution of the types of EEG pattern in the total psychotic group showed that 27 per cent. had "A" types of pattern and 24 per cent. had "MF" types. These percentages were lower than among "normals."

The "MF" and "B" types of patterns were almost equally distributed in the schizophrenics and included 50 per cent. of the entire group. Since these two types of pattern have a fast frequency component in common which differentiates them from other types of patterns, they were combined as one for purposes of comparison. By contrast, 36 per cent. of the manic-depressive group had "A" types of patterns which represented the largest number of any one type of EEG pattern.

The common baseline for alpha frequencies among "normals" is 10 to 10·5 cycles. Only 43 per cent. of the total psychotic series had alpha frequencies in this range. Of the remainder

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29 per cent. of the schizophrenics had alphas slower than 10 cycles, and 32 per cent. had alphas faster than 10·5 cycles. Of the manic-depressives outside the baseline alpha range, 32 per cent. had slow alphas and only 15 per cent. had fast alphas. Schizophrenics were found to have fewer EEGs with alphas of 10 to 10·5 cycles, but twice the number of fast alphas, in contrast to the manic-depressives.

The findings suggest more cortical activity among the schizophrenics, as implied by the fast component and high percentage of " MF " and " B " types of patterns, than by the " A " types of patterns characteristic of the manic-depressive group. The synchronization of cortical activity, however, is clearer in the " A " type of pattern, and it is the degree of synchronization of cortical activity in the EEGs which appears to differentiate the schizophrenics from the manic-depressives.

The presence of " choppy " activity (10), which is in a faster frequency range than the fast frequencies characteristic of the " MF " and " B " types of patterns, or fast alpha frequencies, was found in 61 per cent. of the schizophrenics in contrast to 39 per cent. of the manic-depressives. These findings are striking and significant since they are not related to type of pattern, alpha, or the factor of age. The " choppy " activity is regarded by the author as indicating, primarily, overstimulation or irritation of the cortex, which is due to unsynchronized activity within the central nervous system. This hypothesis is supported by animal experiments (1, 2, 3, 4, 12, 14, 15, 16). With this assumption, it might account for apparent early deterioration in schizophrenics as a secondary effect of prolonged or continuous overactivity. It was found to be present in 47 per cent. of the schizophrenics and in only 3 per cent. of the manic-depressives under 40 years of age.

Comparison of the EEGs of old persons suffering from cerebral arteriosclerosis, and deteriorated schizophrenics under 40 years, showed that this " choppy " activity is not associated with old age nor cerebral arteriosclerosis.

Experiments with mescalin on " normal " individuals, by Sulzbach and the author (not yet published), demonstrated the occurrence of the " choppy " activity with the appearance of schizophrenic-like symptoms. As the mescalin wore off both the " choppy " activity and the schizophrenic-like symptoms began to fade out at the same time, and the subject became normal again.

These findings give definite leads to a further understanding of schizophrenia, and support the hypothesis that schizophrenia may be inherent, or recognized at an early age. The EEGs clearly demonstrate that the condition is *primarily* not one of physiological sluggishness.

(Author's abstr.)

Unidirectional Electrostimulated Convulsive Therapy.

(1) Unidirectional electro-stimulation was therapeutically applied in convulsive doses to 176 hospitalized psychiatric patients. The present report covers 2,746 convulsive reactions induced through left temple (negative), vertex-of-skull (positive) electrode placements.

(2) The threshold convulsive dose, expressed in milliampere seconds (product of intensity and duration of stimulation), was determined for four different types of unidirectional electrostimulation. The technique for obtaining threshold convulsive doses was described.

(3) Type A1 stimulation consisting of rectified waves at 60/seconds, each wave lasting 1/120 second with intervals of 1/120 second was tried in 154 instances. Practically 68 per cent. of the trials gave convulsive thresholds at 50 mA. seconds or less, with 45 per cent. requiring intensity level of 46–60 mA.

(4) Type A2 stimulation designated as type A1 waves interrupted by a make commutator at 10/seconds giving rise to impulse bursts of 1/20 second was tried in 1,735 instances. In 83 per cent. of the trials the convulsive dose was 50 mA. seconds or less with 52 per cent. in the 26–50 mA. second group and 31 per cent. requiring 1–25 mA. seconds. The intensity level was in the 16–30 mA. group in over 70 per cent. of the trials.

(5) Type C2 stimulation is described as 10/seconds commutator interrupted type C1 wave form. Type C1 is a 60/second, slightly smoothed (filtered) rectified wave form, each wave lasting 1/60 second with no interval. Of the 270 convulsive doses by type C2 stimulation, 66 per cent. occurred at 50 mA. seconds or less, with the intensity level in the 16–30 mA. group in 72 per cent. of the trials.

(6) Type C3 stimulation, described as the type C2 form further interrupted by rapid manipulation of the hand switch, was given 587 trials. Of these, practically all occurred at doses of 50 mA. seconds or less, with 80 per cent. at 1–25 mA. seconds. This markedly low convulsive dose more than offset the higher intensities required (46–90 mA. in 82 per cent. of the trials).

(7) Unidirectional electrostimulation seemed to offer convulsive doses markedly less than required by techniques utilizing the alternating current. (Author's abstr.)

Evaluation of Continued Therapy with Phenytoin Sodium.

The total results of all groups comprising the follow-up study of the initial group plus the follow-up study of the new group may be summarized as follows :

Of 93 patients receiving phenobarbital (1½–10 gr.) for 5–44 months there was marked reduction of seizures in 15 per cent. (14) ; moderate reduction in 20·4 per cent. (19) ; and no reduction in 64·5 per cent. (60).

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Of 41 patients receiving phenytoin (1½–9 gr.) for 3–33 months there was marked reduction of seizures in 39 per cent. (16); moderate reduction in 24·3 per cent. (10); and no reduction in 36·5 per cent. (15).

Of 104 patients receiving phenobarbital combined with phenytoin there was marked reduction of seizures in 28·8 per cent. (30); moderate reduction in 21·1 per cent. (22); no reduction in 49·9 per cent. (52).

Analysis of the anticonvulsant effect obtained in 145 patients receiving phenytoin sodium, either alone or combined with phenobarbital during a period of 3–41 months, revealed marked reduction of seizures in 31·7 per cent.; moderate reduction in 22 per cent.; and poor results in 46·2 per cent.

Although several patients were seizure-free for 4–26 consecutive months, these seizure-free intervals were interspersed with recurrence of seizures for at least one to several months, except in one case seizure-free for 38 consecutive months on a combination of 3 gr. of phenytoin sodium and 1 gr. of phenobarbital. Toxic reactions are discussed. (Author's abstr.)

Evaluation of Continued Therapy with Phenytoin Sodium.

Anticonvulsant therapy with phenytoin sodium alone, or combined with phenobarbital, can be administered for periods as long as 41 consecutive months with relatively constant satisfactory results. In addition to favourable anticonvulsant effects, there is often improved disposition, efficiency, and behaviour. In therapeutic doses phenytoin sodium rarely produces hypnosis, and although in a fair proportion of cases it produces toxic manifestations, most of these are innocuous, and none of them should constitute a danger to the patient, provided he is under adequate medical supervision. (Author's abstr.)

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Physiological Suicide, with Regard to the Concept of Hypomesocephaly.

The causes of suicide are not always pathological; they may be purely psychological, which is considered equivalent to physiological. Inadequacy of the midbrain (hypomesocephaly) may impair the life instinct and foster suicidal tendencies. Physiological and hypomesocephalic suicides occur in otherwise normal people. H. L. ANSBACHER (Psychol. Abstr.).

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Effect of Certain Choline Derivatives on Electrical Activity of the Cortex.

The application of a 2·5 to a 10 per cent. solution of acetylcholine chloride to the surface of the cat's cortex produces a pronounced increase in the electrical activity of the cortex.

This electrical response is not altered or prevented by intravenous atropinization (1 mgm. of atropine sulfate per kilogram) of the animal.

Acetylbetamethylcholine chloride, carbamylcholine chloride and a mixture of acetylcholine chloride and prostigmine methylsulfate, when applied in the same way, also produce a change in the electrical record which is indistinguishable from that produced by acetylcholine chloride.

The minimum effective concentrations and duration of effect in each case appear to be closely related to the stability of the solution in the presence of cholinesterase. The more stable the solution the lower the minimum effective concentration and the longer the effect will last.

Acetylcholine chloride appears to be rapidly destroyed by the living cortex.

It is felt that in the light of present knowledge the effect of these drugs on the cortex is comparable to the well-known effect of acetylcholine chloride on the sympathetic ganglion and the myoneural junction of skeletal muscle.

Attention is drawn to the fact that acetylcholine chloride acts as a convulsant in both human beings and in cats, and to the similarities in the form and properties of the electrical activity of the cortex during convulsive seizures and after the experimental application of acetylcholine chloride.

Since acetylcholine is known to be a normal constituent of the brain and is felt by many to be important in the mediation of the nerve impulse, the facts previously cited suggest the possibility that disorders in the metabolism of acetylcholine may be concerned in the etiology or mechanism of convulsive seizures in human beings. (Authors' abstr.)

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Intracranial and Extracranial Vascular Accidents in Migraine.

1. Migraine in persons considered otherwise normal is occasionally associated with intracranial and extracranial vascular accidents.

2. Changes in caliber of cranial blood vessels known to occur during attacks of migraine are probably predisposing factors in hemorrhage and occlusion.

3. Activity producing sudden increase in pressure within the blood vessels of the head during the migraine headache is a precipitating factor in hemorrhage.

4. Unless such vascular accidents can be attributed to latent structural lesions of cranial blood vessels, migraine should be regarded as an instance of disordered function capable of causing irreversible tissue change. (Author's abstr.)

Water Metabolism in Relation to Convulsions: (2) Specific Gravity of Blood and Blood Serum.

In a series of 31 epileptic patients the oral administration of 2,000 c.c. of water within a period of 15 to 30 minutes combined with injections of pitressin produced a maximum average decrease in the specific gravity of the blood serum of 0·0014 one hour after drinking of water was begun.

In another series of 10 epileptic patients, the maximum mean decrease in specific gravity of the whole blood after ingestion of 2,000 c.c. of water, without the use of solution of posterior pituitary, was 0·0011, which was statistically without significance.

By means of determination of the specific gravity it is therefore possible to detect a small change in the direction of dilution of the blood after rapid oral ingestion of 2,000 c.c. of water, but this change on the average is apparently slight, corresponding to lowering of the protein content of the serum through a range of 0·5 gm. per hundred cubic centimeters.

Only one of the 41 patients exhibited a convulsive seizure during the course of these tests.

It is difficult to induce a state of hydremia in a clinical sense in the adult human subject by excessive oral fluid intake supplemented by antidiuretic measures. (Authors' abstr.)

Neuropathologic Changes in Arteriosclerotic Psychoses and their Psychiatric Significance.

A neuropathologic study of 28 cases of psychoses with cerebral arteriosclerosis is reported.

In all cases there was a variety of focal cerebral lesions, the most important of which were areas of softening and acellular or devastated areas. The observations indicated that the different types of focal lesions do not constitute separate anatomic or clinical forms of arteriosclerotic psychosis. The basal ganglia were more vulnerable than other parts of the brain, but in no case was the damage confined exclusively to these structures.

A scrutiny of the relationship between the extent of the neuropathologic changes and the degree of intellectual deterioration revealed numerous discrepancies; in many instances the psychosis could not be adequately explained by anatomic considerations alone. It is believed that the discrepancies are based on differences in the capacity of different persons to compensate for damage to the brain. Examples are given to illustrate that cerebral lesions do not inevitably produce psychotic disturbances. Attention is directed to qualities of the living patient as an important factor in the origin of the mental disorder. It is suggested that patients with an ill-balanced mental make-up possess weaker compensatory powers, and are thus more likely to acquire a psychosis than other persons with cerebral arteriosclerosis. (Author's abstr.)

Intraneural Conditioning: Cerebellar Conditioned Reflexes.

These experiments represent a study of intraneural conditioned responses established from movements initiated in the cerebellum. The cerebellar movements were produced by stimulation of the neocerebellum in chronic preparations (dogs), with induced electrical currents. The movements elicited were contractions of the ipsilateral ear, neck or shoulder muscles; with moderate electric shock they occurred without evidence of pain or disturbance to the animal.

Such movements were made the basis for conditioned responses by preceding the electric shock with a bell or light. Both excitatory and inhibitory conditioned responses could be formed from the cerebellum with the same ease that they can be formed by using a painful shock applied to the skin of the leg.

Thus intraneural conditioned responses can be established on the basis of cerebellar movements. The cerebellum may have an independent higher integrative function, or this apparent integration may be brought about through the thalamus and the cerebral cortex.

(Authors' abstr.)

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Blood Coagulation in Disseminated Sclerosis and Other Diseases of Brain Stem and Cord.

The reaction of the blood coagulation time to the intravenous administration of typhoid vaccine and to the subcutaneous administration of epinephrine was studied in patients with disseminated sclerosis and in patients with other disorders of the brain stem and spinal cord.

To the administration of typhoid vaccine both groups of patients responded with a reduction in coagulation time, the drop being 25 per cent. greater at maximum in disseminated sclerosis. The patients with disseminated sclerosis showed a prolongation of the reduction in clotting time three times as great as the patients with other disorders.

To epinephrine the responses were similar. The intensity of the response was 40 per cent. greater at maximum in patients with disseminated sclerosis than in patients with the other disorders. The duration of the reduced coagulation time for disseminated sclerosis was more than twice that for the other diseases.

It is suggested that in disseminated sclerosis there is a constitutional or acquired disorder of the blood-clotting mechanism which makes it more sensitive to exogenous or endogenous stimuli which tend to reduce the blood coagulation time. Intensive or repeated stimulation of this oversensitive mechanism may lead to intravascular thrombosis under certain conditions.

The disorder of blood coagulation is characteristic of disseminated sclerosis, and was not found in patients with the other diseases of the brain stem and spinal cord studied.

(Author's abstr.)

Distribution of Alkaline Phosphatase in Normal and in Neoplastic Tissues of the Nervous System: A Histochemical Study.

The distribution of alkaline phosphatase in normal and in pathologic tissues of the nervous system has been investigated, a method based on that developed by Gomori and by Takamatsu being utilized. The species studied included chicken, mouse, cat and man.

Pronounced alkaline phosphatase activity was present in the endothelium of the blood vessels of the central nervous system and in the arachnoid; the phosphatase activity in the parenchyma of the nervous system varied in different species and in different portions of the nervous system, the greatest activity being found in the brain stem of the chick. The cellular elements of the spinal fluid were negative for phosphatase.

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Of the tumors studied, the phosphatase activity of the meningiomas was most striking. Moderate activity was present in several astrocytomas, in one oligodendroglioma and in astrocytic areas of one glioblastoma. In many tumors the parenchyma was negative for phosphatase, while the vascular endothelium was often positive. The vascular endothelium in the tumors was less constantly stained for phosphatase than that of the vessels of normal nerve tissue. Apparently the phosphatase content of tumors of the nervous system can be correlated roughly with (1) the phosphatase activity of the homologous normal tissue, and (2) the tendency of the tumor to become calcified.

Phosphatase was present in areas of astrocytosis, such as the chronic plaques of patients with multiple sclerosis.

It is suggested that the phosphatase in vascular endothelium may play a role in the passage of dextrose through the capillary wall, similar to that suggested by Lundsgaard to explain the passage of dextrose through the intestinal wall and the proximal convoluted tubule of the kidney.

The histochemical technic for phosphatase provides a uniquely effective method for demonstrating vessels, since it stains the vascular endothelium. By preparing thick serial pyroxylin sections and staining for phosphatase one may obtain a more complete picture of the vascular tree than that obtained by other methods. Studies of the vascular supply of various portions of the nervous system by this method are practicable.

The method has a limited usefulness in diagnosis of tumors when employed in conjunction with other technics. (Authors' abstr.)

The Pyramidal Tract: A Study of Retrograde Degeneration in the Monkey.

Retrograde degeneration with breakdown and loss of neurons does not occur in the pyramidal system of the monkey after section of the pyramidal fibers. Changes occur in the so-called Betz, or giant, cells of area 4, characterized by shrinkage and loss of Nissl substance, so that the normal configuration of these cells is lost. The Nissl substance may not be concerned with the nutrition and metabolism of the axon. The author believes the retrograde method fails to prove that the so-called Betz, or giant, cells give sole origin to the pyramidal tract fibers. The question is raised whether retrograde degeneration with dissolution of axis-cylinders can be produced in the spinal cord and brain stem of the central nervous system.

(Author's abstr.)

Intelligence in Cerebral Deficit States and Schizophrenia Measured by Kohs Block Test.

The Kohs block test offers a means of measuring the intelligence of persons suffering from intellectual deficits after cerebral damage, as it tests the functioning of the intellect at the moment relatively free from the influence of material which had been acquired prior to damage to the brain. With 5 aphasic patients and with 21 patients suffering from cerebral deficit states the test appeared to afford a good index of the intellectual resources. In 3 patients the clinical improvement was paralleled by appropriate increases in the score on the Kohs test.

As a test for the presence of deterioration the performance on the Kohs test is contrasted with the score on a vocabulary test. The advantages and limitations of the procedure are discussed. Twenty patients suffering from definite cerebral lesions with deterioration showed a mean difference of 4·2 years between the mental age on the vocabulary test and that on the Kohs test. Fifteen patients with schizophrenia showed no significant mean difference between the mental ages as determined by the two tests. Of 21 patients with deterioration due to cerebral lesions, all except 2 showed a difference of at least 2 years 4 months between the vocabulary and the Kohs determinations of the mental ages. None of the 15 schizophrenic patients showed a Kohs mental age as much as 2 years lower than the vocabulary mental age.

On the basis of the material, it is suggested that when the mental age on the Kohs test is equal to or higher than the mental age on the vocabulary test, it is unlikely that the patient is deteriorated unless a specific memory deficit is present. As the distribution curve and scatter for persons with intact brains are not known, it cannot be stated exactly what degree of difference between the vocabulary and the Kohs determination can be taken to signify a cerebral lesion. However, the test has shown itself a reliable adjunct to clinical studies, and even in its present state it suggests that when the Kohs mental age is more than 2 years lower than the vocabulary mental age, cerebral defects impairing the intellectual functioning should be considered. Greater differences add to the evidence proportionately.

The excellent performances of the schizophrenic patients on the Kohs test indicate that such patients may be capable of a high order of impersonal abstraction and may show no impairment of general intelligence. The thinking disorders of schizophrenic patients should not be included in uncritical fashion with the disabilities following damage to the brain.

(Authors' abstr.)

NOVEMBER.

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Insulin Sensitivity of Patients with Mental Disease: Factors in their Serum Affecting Action of Insulin.

A group of 16 patients, consisting of 13 with dementia praecox, 2 with psychoneurosis and 1 with a neuroendocrine disturbance, were tested as regards their sensitivity to test doses of insulin as reflected by the changes in the blood-sugar level, according to the method of Csépai and Ernst.

Of the patients with dementia praecox, some showed a normal response and others either an increased or a decreased sensitivity to the test dose of insulin.

A group of 7 patients with dementia praecox were studied by a method similar to that of de Wesselow and Griffiths with regard to the possible presence of substances in the serum which affect the action of insulin.

The serum of some of the patients showed a pronounced antagonistic effect on the action of insulin, while others showed little or no effect.

The results obtained with both tests were compared with the report of Meduna and his co-workers, in which it was claimed that increased amounts of substances antagonistic to the action of insulin were present in the blood of schizophrenic patients.

The possible role of insulin antagonism in the pathogenesis of dementia praecox is discussed and the need for further investigations indicated.

A patient with depression associated with a combined Parkinson and Cushing syndrome showed evidence of resistance to the blood-sugar-lowering effect of insulin, associated with slow recovery to the initial blood-sugar level. The latter effect is in keeping with the claim of Fernbach that patients with Parkinson's disease show slow recovery from the depressed blood-sugar level.

The delayed recovery from the lowered blood-sugar level observed in the patients with dementia praecox may indicate a disturbance in the physiology of the neuro-vegetative system.

No strict correlation was found between the tests and the subsequent dose of insulin required to produce coma during insulin shock. The significance of this observation is discussed.

(Author's abstr.)

Effects of Destruction of Hypothalamus by Tumor.

A case is reported which throws light on the function of the hypothalamus in man. The following abnormalities are ascribed to the destruction of the hypothalamus by tumour: diabetes insipidus; suppression of function of the anterior lobe of the pituitary, the thyroid, the ovaries and the adrenal glands; disturbance of fat metabolism; disturbance of sleep; disturbance of thermal regulation, and disturbance of personality.

The role of the thyroid in diabetes insipidus is demonstrated, and information bearing on the anatomic and physiologic relationship between the hypothalamus and the anterior lobe of the pituitary gland is presented. (Author's abstr.)

Use of Testosterone Propionate in Treatment of Involutional Psychosis in the Male.

Twenty male patients suffering from involutional psychoses were treated with testosterone propionate, administered intramuscularly for a period of from six weeks to three months.

Sixty-five per cent. of the patients responded well. In the control group treated by procedures previously employed, only 46 per cent. improved. The best results were obtained with

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the mild and moderately severe types. The severe type did not respond well to androgenic therapy and may represent a different clinical entity from the other two.

The therapeutic test with testosterone propionate may be of some diagnostic value in differentiating the milder type, in which androgenic deficiency is an important etiologic factor, from the more severe type, in which other psychologic or organic factors predominate.

(Authors' abstr.)

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BOSTON SOCIETY OF PSYCHIATRY AND NEUROLOGY.

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Relief of Pain by Mesencephalic Tractotomy.

Unilateral intractable pain may be alleviated by section of the spino-thalamic and secondary trigeminal tracts at the mesencephalon. This procedure produces hemianalgesia and hemithermanesthesia on the side of the body opposite the lesion immediately after the operation, with a peculiar feeling of "numbness" or "deadness." There is slight weakness of the contralateral leg, demonstrable only by having the patient hop or stand on that leg alone. Co-ordination is normal. Proprioceptive sensibilities are not impaired. (Author's abstr.)

Problem of Imperception of Disease and of Impaired Body Territories with Organic Lesions: Relation to Body Scheme and its Disorders.

The problem of the phenomena of imperception of disease and of the related types of amnesia for or non-recognition of or consecutive psychotic production with respect to the impaired parts or side of the body is studied. The anatomic, physiologic, psychologic and clinical aspects of the subject are discussed. The question of the value of the phenomena in cerebral localization is also alluded to. The concept of the so-called body scheme and the relation of these phenomena to it are examined. The conclusion is reached, on the basis of available evidence, that they are to be considered as indirect disorders of the body image. The direct disorders of the body scheme are reviewed and analyzed in this connection. The differentiation between the two groups of disorders and their particular characteristics is indicated. An attempt is made to categorize the various disturbances in the sphere of body scheme that have been observed with organic conditions.

In approaching the subject from a clinical-phenomenologic standpoint, the following classification of the diverse manifestations of body disorientation referable to the body scheme is arrived at: (1) Autotopopagnosia, or somatotopagnosia, i.e., general disorientation and lack of

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recognition in the sphere of the body and in the inter-relation of its individual parts. (2) Finger agnosia, i.e., primary specific disorientation and loss of recognition in the sphere of the fingers of both hands and in their spatial relationship. (3) Agnosia for laterality in the somatic sphere, i.e., disorientation for right and left of the body (usually associated with either of the two conditions just mentioned). (4) Anosognosia, i.e., lack of knowledge of disease, most frequently observed with left cerebral hemiplegia. Disturbance in orientation for laterality, if present, refers to the diseased side only. (5) Autosomatamnesia and autosomatagnosia, respectively, i.e., amnestic and agnostic unawareness of the impaired parts or half of the body, varying in degrees from simple neglect of their presence to the experience of their non-existence. Disorientation for laterality, if demonstrable, is related to the non-appreciated side. (6) Somatoparaphrenia, i.e., specific psychic elaboration (marked by formation of illusions, confabulations and delusions) with respect to the affected members or side of the body, believed or experienced as absent. (7) Fantom limb, i.e., non-realization of actual absence or experience of possession of a lost member of the body.

I believe that the study of the body scheme and its disorders associated with lesions of the brain should be given more attention than has hitherto been accorded it. The fundamental importance of the facts emerging from the study of these disorders for an understanding of many an obscure phenomenon in the fields of neurology and psychiatry is emphasized.

(Author's abstr.)

Convulsions in Non-epileptic Patients on Withdrawal of Barbiturates, Alcohol and Other Drugs.

The cases of seven non-epileptic patients who had convulsions four days after withdrawal of soluble barbital are reported; they had been accustomed to this sedative for one to two years. None of them had seizures prior to or after this occurrence.

Seizures occur after withdrawal of the various barbiturates, paraldehyde and other hypnotics of the aliphatic group. They are seen only after prolonged medication, never after acute intoxication with the same drug.

The dangerous increase of seizures in epileptic persons following sudden discontinuance of phenobarbital is explainable by the same mechanism. It seems that in this respect phenobarbital acts differently from other anticonvulsive drugs, such as bromides and dilantin.

The literature on withdrawal seizures after chronic intoxication with such hypnotics as barbiturates and paraldehyde reveals that these convulsions, in most instances, are associated with a delirium-like psychosis of several days' duration.

Withdrawal seems to be equally responsible for convulsions in cases of so-called alcohol epilepsy. Alcohol in large doses is a narcotic, and fits occur only during the sobering-up process, as demonstrated in two cases reported here. The possible relation between alcoholic delirium and seizures and the analogous manifestations in intoxication with barbiturates and paraldehyde are discussed.

Ether convulsions are mentioned as not belonging in the group of withdrawal seizures.

The time interval between withdrawal and convulsions or psychosis is rather constant for each drug.

No immediate action of the drug, but some unknown physico-chemical process developing after withdrawal in a chronically intoxicated patient, seems to be responsible for both the convulsions and the withdrawal psychosis. (Author's abstr.)

Electroencephalogram Accompanying Hyperactive Carotid Sinus Reflex and Orthostatic Syncope.

The electrical activity of the cortex has been studied in 17 patients with hyperactive carotid sinus reflexes and in three normal subjects in whom orthostatic hypotension developed after the ingestion of sodium nitrite. Electroencephalograms and cortical frequency spectrums were obtained before and during syncope. As a control, the response to compression of the carotid sinus was studied in 15 normal subjects and in 20 epileptic patients.

On the basis of these studies the following conclusions were drawn:

Slow waves of cortical origin are not prominent in carotid sinus syncope of either the circulatory or the central type, and ordinarily no gross disorder of the cortical rhythm is apparent during the syncope.

The most characteristic change that occurs in all types of carotid sinus syncope is a sudden decrease in amplitude; this change is difficult to distinguish from an ordinary attention response.

In rare cases of the cardiodepressor type a short period of slow activity occurs just before consciousness is lost.

In the majority of cases of carotid sinus syncope of the circulatory type spectrum analysis with the Grass analyzer reveals slowing of cortical activity during the period of unconsciousness.

In the majority of cases of carotid sinus syncope of the central type spectrum analysis reveals an increase in the frequency of cortical activity during the period of unconsciousness.

The failure to find evidence of gross slowing of cortical activity in cases of the circulatory type of carotid sinus syncope is explained by the assumption that cortical activity is primarily accelerated by stimulation of the carotid sinus, and that it is stopped, rather than slowed, by the sudden cerebral anemia.

The central type of hyperactive carotid sinus reflex can be considered a type of trigger zone epilepsy in which there is only slight cortical involvement. (Authors' abstr.)

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Effect of Hyperventilation on Electroencephalogram of Schizophrenic and Non-psychotic Subjects.

The influence of hyperventilation on the electroencephalograms of 35 schizophrenic patients and of 35 normal control subjects was studied.

A comparison of the two groups revealed no striking differences in the effect of hyperventilation on the amount of alpha activity. However, a second hyperventilation following the first by five or ten minutes did alter the number of persons whose per cent. time alpha increased or decreased on overventilation.

Slow waves appeared in the electroencephalograms of 55 per cent. of the control group on hyperventilation. The schizophrenic patients, however, were unresponsive in this respect, only 3 per cent. (one patient) showing slow activity. This unresponsiveness of the schizophrenic patients could not be correlated with such factors as age, level of initial per cent. time alpha, co-operation or time of day when observed.

It is suggested that some condition exists in schizophrenia which is unfavorable for synchronization of low frequencies, and other instances of the schizophrenic person's unresponsiveness to variables which produce slow rhythms in normal persons are cited.

Knowledge of the mechanism involved in the appearance of slow waves in the electroencephalogram on hyperventilation should contribute to understanding of the nature of schizophrenia.

(Authors' abstr.)

True Fatty Degeneration in Sensory Neurons of the Aged.

A study of aged human and animal sensory ganglion cells shows widespread fatty degeneration. This change is demonstrable as actual fat droplets when specific stains are applied to frozen sections, but appears as vacuoles in paraffin-silver preparations.

In the efferent sympathetic cells this destructive process is not as prevalent as in the afferent neurons. The reason for this difference is unknown.

Immediate fixation of the material of experimental animals precludes the possibility that these changes in the nerve cells represent post-mortem autolysis. The alterations are therefore valid ante-mortem changes.

Variations in the appearance of the lipoidal accumulations with different histologic technics are described. A recognition of these differences will eliminate erroneous interpretations of their pathologic significance.

The general literature pertaining to the problem is reviewed and discussed.

(Authors' abstr.)

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OCTOBER, 1942.

*Tumors of the Striatothalamic and Related Regions: Their Probable Source of Origin and More Common Forms. *Globus, J. H., and Kuhlenbeck, H.* 674
Heterotopic Brain Tissue in the Lungs of Two Anencephalic Monsters. *Potter, E. L., and Young, R. L.* 1009
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Tumors of the Striatothalamic and Related Regions: Their Probable Source of Origin and More Common Forms.

Evidence is presented to emphasize the significance of embryonal and histogenetic factors in the production of brain tumors.

It is demonstrated that these factors are operative particularly in the region designated as the striato-thalamic junction, including the sulcus terminalis, and in other areas—the zone of coalescence of the anterior horns of the lateral ventricles and the subependymal cell plate about the nucleus caudatus and the septum pellucidum.

These zones, the striato-thalamic and others, have been found to be frequent sites of tumor formation. The explanation for this is to be found in the fact that they constitute common sites for embryonal residues.

The tumors most commonly found in these situations are identified in accordance with a simple classification. The spongioneuroblastic variety is the most frequent, although others such as spongioblastoma multiforme or ependymale, as well as transitional forms, are occasionally encountered there. Tumors of the spongioneuroblastic variety are not infrequently multiple, with their distribution in zones of predilection for embryonal residues. The primitive character of embryonal residues found in the aforementioned locations is in all probability responsible for the character of the tumors developing there.

Further evidence has been presented that the spongioneuroblastoma and its transitional forms are of a type of tumor in which both neural and glial elements coexist in varying ratios.

Tuberous sclerosis has been found frequently associated with the spongioneuroblastic variety of tumor, and the fact that numerous ependymal granulations are frequently found in spongioneuroblastoma and tuberous sclerosis again points to the significance of the subependymal cell plate as the source of neoplastic alterations.

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Clinically this type of tumor is characterized mainly by the rapidity of the unfolding of the clinical picture in a large number of cases, by the frequency of convulsive seizures, by the depreciation of alertness and by somnolence as a frequent manifestation. (Authors' abstr.)

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*Brain Bioelectrical Investigations on Fatigue and Sleep. *Grüttner, R., and Bonkálo, A.* 652

Brain Bioelectrical Investigations on Fatigue and Sleep.

In fatigue alpha waves become irregular and discontinuous. Before sleep onset, a reduction of normal cortical activity is observed, but a considerable reduction of activity through fatigue does not necessarily lead to sleep. During sleep the cortex is, at least at times, very active. This activity, however, differs from that of the waking state. During sleep frontal activity is greater than occipital, while the reverse holds true during waking.

H. L. Ansbacher (Psychol. Abstr.).

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*Aphasia in Children. *Guttman, E.* 205
Cerebello-olivary Degeneration. An Example of Heredo-familial Incidence. *Parkes-Weber, F., and Greenfield, J. G.* 220

Aphasia in Children.

Thirty cases of cerebral hemisphere lesions in children have been examined with a view to comparing with adult cases the frequency, clinical picture, and prognosis of acquired aphasia in children.

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In this group aphasia occurred with the same regularity as in adults.

In all cases under ten years and in some between ten and fourteen, the clinical picture is uniformly that of diminished speech production, with dysarthria and telegraphic style in the recovery period; this is equally true of cases with frontal and temporal lesions. The latter show disturbances of speech, receptive as well as expressive.

The recovery from aphasia of the purely motor type is surprisingly rapid, and most cases with a reversible lesion have recovered within four weeks.

Some cases of aphasia which were submitted to intelligence tests showed very little, if any, impairment; some cases with lesions of the right hemisphere and no aphasia did show retardation of intellectual development. This, if confirmed by a wider survey, would point to the brain damage rather than to the aphasia as the factor responsible for the disturbance of intelligence.

(Author's abstr.)

SEPTEMBER, 1942.

The Effect of Prolonged Increased Cerebrospinal Fluid Pressure on the Venous Pressure in the Superior Longitudinal Sinus of the Dog. *Bedford, T. H. B.* 233
*The Effects of Striatal Injury. *Mettler, F. A. and C. C.* 242
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The Repair of Large Gaps in the Peripheral Nerves. *Sanders, F. K.* 281

The Effects of Striatal Injury.

(1) Small, unilateral lesions of the striatum may be sustained without producing easily detectable signs of physiological deficit but larger, bilateral lesions produce definite evidences of motor release and of fatuity.

(2) A specific "leaping" sign is described whereby striatal encroachment in carnivora may be distinguished from cortical injury alone.

(3) These signs of release are not the result of irritation, even though they become less obvious as time goes on since (*a*) such animals always remain potentially hyperkinetic and can be activated, if this is done properly; (*b*) even when the hyperkinesia is at its height, such animals can be quieted by reducing tactile and proprioceptive stimulation of the extremities; and (*c*) because specific stimulation of the striatum never produces positive motor but only inhibitory effects.

(4) The characteristics of motor release seen after striatal injury are discussed.

(Authors' abstr.)

Electroencephalographic Studies in Epilepsy.

(1) 86 per cent. of EEG tracings on 625 epileptics were borderline or abnormal, and 14 per cent. were normal.

(2) The authors would stress the variability of EEG tracings of epileptic patients.

(3) Many of the patterns obtained from epileptics are found in other neuro-psychiatric conditions. The spike and wave patterns usually found in epileptics occurred in less than 10 per cent. of our 625 cases. Less than half of these spike and wave patterns were found in *petit mal* epileptics.

(4) Because of the great variety of patterns obtained in epileptics, and because many of these patterns resembled those found in other disorders, the use of clinical terminology in describing the brain-wave patterns of epileptics is misleading.

(5) The EEG can continue to be of practical value to the neuro-psychiatrist in the diagnosis of epilepsy when used as an adjunct in conjunction with other laboratory data, the history and the clinical findings.

(Authors' abstr.)

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Fundamental Principles in Aphasia Based on Autopsy Material of Crucial Cases.

Six cases are described and illustrated to support conclusions that (1) the putamina are not involved in language; (2) the minor cerebral hemisphere may take over language functions; (3) visual, auditory, or motor language functions may be taken over separately; (4) "an artificial writing mechanism may be formed on the minor side by training" without necessarily involving transfer of other language processes; (5) the major temporal and major occipital lobes need not be ipsilateral. D. K. SPELT (Psychol. Abstr.).

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Drugs and Mental Disease.

Of the 115,845 individual admissions to Massachusetts Mental Hospitals from 1917 to 1937 inclusive, 841 were associated with the excessive use of drugs. Order of frequency of involvement was opium derivatives, 363; barbiturates, 208; bromides, 101; other sedatives, 27; analgesics, 15; gases, 19; metals, 18. There was a higher incidence of persons with college education and persons from marginal economic levels than among other sorts of admissions. Native-born residents were more numerous than immigrants. Recovery-rate of cases of mental disease due to drugs is high, and death-rate is low. W. L. WILKINS (Psychol. Abstr.).

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The Electroencephalogram in Neurosyphilis.

An attempt has been made to correlate rapid frequency (samples 4, 6 and 7) and slow frequency patterns (samples 9 through 12) with the clinical picture. In general paresis, rapid activity is more frequently encountered in those cases in which the psychotic elements predominate, while slow activity is more often found in those cases in which neurologic signs stand out in the clinical picture. In juvenile paresis slow activity is more common. The fact that the infection involves the brain before it reaches maturity in these cases may account for the predominance of slow activity. (Authors' abstr.)

The Relative Efficacy of Various Methods of Treating General Paresis.

Noteworthy progress has been made in the effectiveness of treatment of the general paretic patient by diathermy fever combined with specific chemotherapy. The result has been a marked decrease in the hospital death-rate and a marked increase in the discharged-improved rate.

However, further improvements in the results should be obtained (1) if all general paretic patients are given intensive antiluetic chemotherapy as soon as the diagnosis is suspected, regardless of age or physical condition, and (2) if specific chemotherapy is augmented by diathermy fever as soon as the diagnosis is established. These factors should be of considerable help in further lowering the death-rate and increasing the discharged-improved rate.

The prevention of acute infections in the general paretic patient will do much to lower the hospital death-rate still further. To neglect acute infection means signing the death warrant of the general paretic patient.

A careful study is warranted to find the agent or agents responsible for a decrease of almost 30 per cent. in the number of physical wrecks being admitted to the hospital with general paresis. (Author's abstr.)

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Electrophysiological Analysis of the Influence of the Sympathetic Nervous System on Cutaneous Reception.

Action potentials were recorded during stimulation of the sensitive skin nerves with touch, pain, and chemical stimuli. The effect of the sympathetic nervous system on the tactile skin receptors manifested itself in a reduction in frequency and duration of the discharges. The effect of the sympathetic nervous system on the pain receptors was the reverse. The views of Pachornoff and Propper-Graschtschenkoff that the skin receptors are directly influenced by the sympathetic nervous system are supported. H. L. ANSBACHER (Psychol. Abstr.).

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Studies on the Nutritional Basis of Abnormal Behavior in Albino Rats.

Groups of albino rats were maintained on different levels of vitamin B_1 intake, which induced partial inanition. These animals were tested regularly for susceptibility to convulsive seizures by exposure to a standard auditory stimulus. During a 40-day experimental period a rising incidence of seizures was observed in all groups which was roughly parallel. There was some evidence for a critical level of vitamin B_1 intake which results in maximum sensitivity.

With food intake held constant at a low level, all groups showed a marked reduction in number of seizures during an additional 40 days of testing when certain additional vitamins and mineral supplements were provided. This indicates that protection was afforded by the supplement *per se*, or that they permitted a more effective utilization of the substances already present in the reduced food allowance.

The findings provide additional evidence to that previously presented that both caloric intake and a deficiency of essential food substances are important factors in the etiology of sound-induced seizures in the rat. (Authors' abstr.)

Cortical Localization of Symbolic Processes in the Rat.

Animals were trained in the linear maze, under the conditions described, until they reached a comparatively stable level of performance. They were then subjected to destruction of the cerebral cortex in varying amounts and positions and subsequently tested for retention and relearning of the maze-habit. Fourteen animals completed the experiment.

On the basis of the post-operative results, animals could be divided into two groups: those which showed marked loss of the habit and those which did not. Seven were in each group. With the exception of one rat, whose lesion seemed especially severe, the six showing amnesia had lesions in the frontal projection areas representing the medial and anterior parts of the ventral nucleus of the thalamus and corresponding generally to Fortuyn's area (f). There seemed to be a relation between the extent of destruction in this area and the amount of post-operative recovery, but final acceptance of this conclusion must await more extensive data. The destruction of other areas had no effect upon maze-performance, and the mass of lesions had little to do with post-operative disturbances.

It is clear, therefore, that the frontal areas are of primary importance in the psychological

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processes (which we presume to be of a symbolic character) involved in the maze-performance. A review of the neuro-anatomic relations of these areas to the thalamus and other cortical areas supports the view that there are functional areas in the rat which correspond to the frontal lobes in primates, and that these functional areas may play a role in mediating symbolic processes much as frontal lobes appear to do in primates. (Authors' abstr.)

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The Reorientation and Maze Behavior of the Rat after Noise-Fright and Electroshock Convulsions.

(1) Twenty-four rats learned a simple right-wrong position discrimination water-maze to a criterion of 10 consecutive trials without error and with a corresponding time score of 4 seconds or less. Ten of these rats were subjected to a series of noise-fright convulsions and 14 of the animals were given several electroshock convulsions. All the rats were placed in the water-maze immediately after the cessation of convulsions and left to swim spontaneously to the correct exit. One hundred and fifty additional trials were made by forcing animals to swim at time intervals of 2, 3 and 5 minutes after electroshock convulsions. Altogether, the trials after 250 electrical convulsions, 50 noise-fright convulsions and 30 noise-fright running reactions were observed in this study.

(2) The electrically induced convulsion produces longer lasting disorientation and a greater retardation of spontaneously initiated movement than does a noise-fright attack.

(3) Error scores are the same for the immediate post-convulsive maze performance of both groups.

(4) Beginning after the second to fifth electroshock convulsion, rats usually display many of the signs of " experimental neurosis."

(5) The maze performance of rats, in so far as error scores are concerned, does not appear to be affected by a long series of convulsions evoked either by electric shock or by noise-fright stimulation. (Authors' abstr.)

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Studies of Abnormal Behavior in the Rat. XI: Factors that Influence the Type of Reaction to Metrazol.

This experiment was undertaken to determine the specific factors responsible for the distinctly different reactions to metrazol obtained in two groups of rats. Each factor in which the groups differed has been tested in relation to its influence on the threshold and on the convulsive pattern for metrazol.

The most important factor in the two groups was the difference of strain. One strain was found to have a high incidence of individuals which reacted abnormally to auditory stimulation and has been designated as the unstable strain. The other was found to have a low incidence of such individuals and has been designated as the stable strain.

Comparing animals similarly treated in the two strains it was found that the metrazol-induced convulsion of the unstable strain was more elaborate and required a smaller dose than did that of the stable strain.

The metrazol reaction was also subject to modification by experience. The following effective conditions were found:

(1) Previous metrazol-induced convulsions cause (*a*) the convulsant threshold for metrazol to fall to a lower and more stable level and (*b*) the form of the convulsion to become more elaborate.

(2) Seizures induced by auditory stimulation have an effect on metrazol convulsions similar to that produced by previous metrazol convulsions, but the effect is less striking. In the unstable strain the seizures influenced both the threshold and the pattern of the metrazol convulsion and in the stable strain only the pattern was somewhat affected.

(3) Exposure to auditory stimulation without resulting abnormal behavior is less effective than sound-induced seizures in altering the reaction to metrazol, but nevertheless it produces a significant effect on the unstable strain.

(4) It is concluded that the instability of the unstable strain is general, rather than specific for either auditory stimulation or metrazol.

Whether or not an individual was potentially abnormal with respect to auditory stimulation was found to be an insignificant factor in the metrazol reaction. The apparent importance of this factor lies in the fact that animals possessing this predisposition are likely to be exposed to such stimulation and thus become altered in their metrazol reactions.

The native tendency to react to auditory stimulation thus distinguishes the strains (which also react differently to metrazol), and yet is not a determining factor in the metrazol reaction. It is therefore concluded that instability in auditory situations and in metrazol reactions are related but independent hereditary factors. (Authors' abstr.)

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The conditioning of the response of the occipital alpha rhythm of the human EEG to a voluntary stimulus (clenching of the fist) was quantitatively studied by determining the alpha, amplitude and activity level (AL) indices of a specific segment of record. This was the two seconds of activity starting 0·67 seconds after the beginning of the voluntary stimulus. Neither the conditioned stimulus alone nor the unconditioned stimulus (light) alone was effective in producing the response. However, pairing of these stimuli produced significant differences in the measured response to the fist-clench. The conditioned response so produced was extinguished by lack of reinforcement and the curve of extinction was a decelerated one. In the measurement of these events, the AL index is found to be the most useful of the three measures employed.

The results are discussed from the viewpoint that they represent a central neurophysiological parallel of events which have hitherto been studied at a more peripheral level.

(Author's abstr.)

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*The "Discharging Function" of the Convulsive Seizure. *Flescher, J.* 274
*Use of D, l, Alpha-Tocopherol Acetate. *Schwarz, G. A., Gammon, G. D., and Masland, R. L.* 286
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Treatment of Epilepsy.

From their experience in the treatment of 137 epileptics, the authors recommend that where the attacks are not controlled by sodium diphenyl hydantoinate alone, this drug should be tried in combination with phenobarbital. To obtain satisfactory results full doses of both drugs must be administered. S. M. COLEMAN.

Visual Hallucination.

A patient with paraldehyde addiction experienced during the withdrawal period a visual hallucination of a characteristic pattern. Various structural details are described and their resemblance to mescaline hallucinations emphasized. An illusionary movement of the hallucination is described. The attempt is made to explain this movement on the basis of a disturbance of spacial stability. That stability is maintained by harmonizing forces belonging to the vestibular and optosensory apparatus. Another case manifesting similar features was used to support the idea that the stability of the individual and of space are inter-related.
S. M. COLEMAN.

Disturbances of Cortical Functions.

An analysis of clinical data indicates that the principle of primary and associated disturbances of the higher cortical functions explains the discrepancies that exist between symptomatology and the site of organic lesions in the temporal lobe. It is suggested that the various neural association systems are so arranged that certain essential parts are concentrated in certain areas of the cortex. A destructive lesion in a vital area might disrupt the entire system; a less strategically located lesion would produce only a partial lesion. S. M. COLEMAN.

"Discharging Function."

By the discharging function of the artificial epileptic attacks a means has been obtained to convey huge amounts of energy inherent to the death and destructive drives and to unload them in an individually and socially harmless manner. It is suggested that favourable results might be obtained in the treatment of other manifest destructive tendencies (constitutional delinquents, etc.). S. M. COLEMAN.

D, l, Alpha-Tocopherol Acetate.

Eighteen patients with different forms of neuromuscular disease were treated orally with the synthetic vitamine E over an average period of five months. There were no objective evidences of improvement in any of the patients. Five cases of dystrophy reported some slight subjective improvement. S. M. COLEMAN.

OCTOBER.

*Primary Melanoma of the Central Nervous System. *Mackay, F. H., and Hurleau, E. F.* 369
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*Wilson's Disease in the Light of Cerebral Changes following Ordinary Acquired Liver Disorders. *Waggoner, R. W., and Malamud, N.* 410
*The Action of Pyridine and Some of its Derivatives in Preventing Experimental Convulsions in Animals. *Pollock, L. J., and Finkelman, I.* 424

Primary Melanoma.

A case of primary melanoma of the brain stem and cervical cord is reported in detail. It is one of the few recorded cases in which the lesion was intramedullary and simulated in many respects a small lesion in the parietal lobe. S. M. COLEMAN.

Muscular Dystrophies.

Six cases of muscular dystrophy were treated with wheat germ oil, alpha-tocopherol, vitamine E concentrate and vitamine B complex. No effect was observed on the urinary excretion of creatine and creatinine due to treatment. Of the six cases, five were unimproved, and one was definitely worse. Two claimed subjective improvement. S. M. COLEMAN.

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The Electrofit.

It is concluded that the electrofit therapy, as far as is known, is a relatively safe form of shock therapy. It has distinct advantages over metrazol and insulin shock therapy. The results obtained are about the same as those obtained by metrazol therapy. In the affective psychoses most authors report 80 per cent. of remissions. Under favourable circumstances the treatment can be administered at the office or in an out-patient department. The apparatus, technique, course of the treatment, indications, manifestations and complications are discussed.

S. M. COLEMAN.

Wilson's Disease.

Five cases of ordinary acquired liver disorder showing cerebral changes are compared with two cases of Wilson's disease. Fundamental clinical and patho-anatomical similarities in the cerebral manifestations of both groups are outlined. It is concluded that Wilson's disease is a primary hepatic disorder which affects the central nervous system secondarily.

S. M. COLEMAN.

Pyridine and its Derivatives.

Pyridine and its derivatives, in appropriate doses, were found significantly to reduce the severity and prevent the occurrence of convulsions following the intravenous injection of metrazol.

S. M. COLEMAN.

J. NEUROPATH. EX. NEUROL.

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*The "Motor" Cortex of the Cat. *Garol, H. W.* 139
The Neural Mechanisms of Athetosis and Tremor. *Bucy, P. C.* 224

The "Motor" Cortex of the Cat.

Using well controlled electrical stimulation the convexity of the cortex was explored. Two types of results were obtained—motor responses and suppression. Peripheral motor responses were most readily obtained from the area gigantopyramidalis of Brodmann and correspond in their cortical arrangement to those found in primates and man, with the exception of the trunk representation. The results show a wider representation of motor response areas on the cortex than heretofore reported. The second type of result has to do with suppression, which manifests itself in two ways. Stimulation of restricted regions in areas 8, 3–4, 2 and 19 produces a suppression effect by causing a transient rise in threshold of foci for motor response or by holding in abeyance motor after-discharge resulting from stimulation. The suppression effect occurs 3–5 minutes after stimulation of the delimited suppressor areas and may persist for 10–20 minutes. Knowledge of the location of these areas is a distinct aid in searching for or mapping responsive areas of the motor cortex.

D. B. LINDSLEY (Psychol. Abstr.).

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*Changes in Normal Electroencephalogram of *Macaca mulatta* with Growth. *Kennard, M. A., and Nims, L. F.* 325
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*The Central Excitatory State Associated with Postural Abnormalities. *Denslow, J. S., and Hassett, C. C.* 393
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Changes in Normal Electroencephalogram of Macaca mulatta *with Growth.*

(1) In the infant monkey cortical potentials (EEG) begin to develop at or before birth, but are not well demarcated until three or four weeks after birth.

(2) From this time until the end of the sixth month there is progressive development and elaboration of the EEG until it resembles that of the adult.

(3) Frequency of waves is about 2–3 per second immediately after birth. It increases to about 7–8 per second during the first six months and then slowly to about 10–12 per second by the end of the second year.

(4) Amplitude is low at birth, increases during the first six months and then slightly decreases.

(5) During the growth period the EEG becomes at once more complex and more uniform. There are less variations of base-line and of type of potential.

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(6) The effect of sleep can be detected in the older animals, but in the newborn infant fluctuations in state of waking or sleeping are too slight and gradual to be correlated with the marked fluctuations in type of EEG, which may, however, be related.

(7) The changes in the development of the infant monkey are like those described for man, and are as far as is known coincident with the anatomical and functional development of the cerebral cortex. (Authors' abstr.)

Effect on Electroencephalogram of Lesions of Cerebral Cortex and Basal Ganglia in Macaca mulatta.

Lesions have been made in cerebral cortex and basal ganglia of 41 monkeys, and electroencephalograms (EEG) recorded before and after operations.

(1) In every instance there is a temporary change in EEG which appears during the first or second post-operative day, and which consists of flattening and slowing of the waves of medium frequency. It is transient; it is independent of the specific area injured; but it is more pronounced following larger lesions.

(2) In acute experiments under dial anesthesia, lesions of cortex or basal ganglia produce no change in EEG.

(3) Following lesions restricted to cerebral cortex thereis no significant change in EEG except the transient one described above.

(4) There was no focal effect of lesions of the cortex, and usually none following combined lesions of cortex and basal ganglia. In a few instances focal epilepsy could be seen.

(5) Lesions of head of caudate nucleus or putamen, or of both, were followed by marked changes in the pattern of cortical potentials. Hypersynchrony of the 8–10 per second waves became intensified, and the 15–20 per second waves became less marked or vanished.

(6) Combined lesions of the motor areas of the cortex with the basal ganglia caused the most marked changes. Hypersynchrony appeared and persisted for as long as two years. True epilepsy, both clinical and in EEG, were found in 5 out of 15 animals.

(7) All the lesions which caused changes in EEG produced the most extreme changes in those animals which had been operated upon in infancy. (Authors' abstr.)

Modification of Cortical Activity by Means of Intermittent Photic Stimulation in the Monkey.

Evidence was found of an effect of intermittent photic stimulation upon the cortical activity of the monkey (*Macaca mulatta*).

The effect was reflected by increased amplitude of cortical response and by stabilization of cortical rhythm. The effect is similar to the driving effect reported by Bishop and his co-workers for rabbit and cat and by various investigators for man.

The range of frequencies found to produce maximal cortical responses in monkey was from 10·5 to 11·5 per second.

The driving effect was found to be present in 100 per cent. of twelve monkeys.
(Authors' abstr.)

Relation of Fibrillation to Acetylcholine and Potassium Sensitivity in Denervated Skeletal Muscle.

Denervation renders skeletal muscle much more sensitive to acetylcholine and, less markedly, to potassium chloride. Small concentrations of these agents, when injected intra-arterially, produce action potentials comparable to and superimposed on those of fibrillation. This excitation is abolished by quinidine in doses which will arrest fibrillation. It is suggested, therefore, that the fibrillation seen in skeletal muscle after lower motor neurone denervation arises from an increased sensitivity of denervated muscle to chemically-induced excitation. The present experiments indicate that acetylcholine, potassium or both may be the usual causative agent or agents. (Authors' abstr.)

Cerebellar Action Potentials in Response to Stimulation of Proprioceptors and Exteroceptors in the Rat.

(1) Cerebellar action potentials in the rat were recorded from surface folia following stimulation of exteroceptive receptors by moving the hair on different regions of the animal's body, and of proprioceptive receptors by tapping the tendons of isolated muscles of the fore and hind limb. The lobules explored were the highest part of the culmen, the lobulus simplex, the folium and tuber vermis, the pyramis, the uvula, crus 1 and crus 2 of the lobulus ansiformis and the lobulus paramedianus.

(2) Of the lobules explored the pyramis showed the most consistent activity following proprioceptive stimulation and the culmen following exteroceptive stimulation. There were marked differences in distribution of the responses depending on which type of stimulation was used. Some of the potentials may have resulted from activity caused by intracerebellar connections.

(3) No consistent differences in the distribution of the responses was detected when different parts of the animal's body were stimulated. Because of the small size of its cerebellum, the rat is not the most suitable animal for this study.

(4) In respect to the cerebellar lobules activated, electrical stimulation of the sciatic nerve resembled exteroceptive stimulation more closely than proprioceptive stimulation. The distribution of activity throughout the cerebellum following electrical stimulation of the sciatic nerve in the rat was more widespread than in the cat, and much more so than in the monkey.
(Authors' abstr.)

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A Comparison of Effects of Upper and Lower Motor Neuron Lesions on Skeletal Muscle.

Using albino rats the atrophy of the gastrocnemius-soleus group of muscles following an upper motor neurone lesion (produced by spinal cord section at the 6th thoracic segment) was compared with the atrophy following a lower motor neurone lesion (section of the sciatic nerve). The two types of lesions produced atrophic processes which were quantitatively similar for the first 14 days. Thereafter the muscle groups with severed upper motor neurones started to recover lost weight while those with lower motor neurones cut showed an uninterrupted development of atrophy. Both types of injury produced hypersensitivity to acetylcholine in the muscles involved. This lasted only as long as the atrophic process was active, and was most marked in the cases of section of the lower motor neurone. Fibrillation was seen only when the lower motor neurone was cut.

Possible causes of the onset and regression of atrophy in skeletal muscle deprived of upper neurone control are discussed. (Authors' abstr.)

Stimulus Frequency as a Means of Analyzing Synaptic Activity.

When trains of electric stimuli are led through needle electrodes to the spinal cord certain wave patterns are set up which have been recorded from the sciatic nerve (decerebrate cats). These consist of a direct wave caused by stimulation of the ventral horn cells and by a number of relayed waves following after different latent periods.

By subtracting the latent period of the direct wave from those of relayed waves the central reflex times of the latter are obtained.

The direct waves follow frequencies of stimulation above 850 per second. The relayed waves follow frequencies which decrease with increasing central reflex times. A curve illustrating limiting frequency as a function of central reflex time is given.

Some relayed waves gradually recruit neurones and thereby increase in size; others have definite frequency optima and thus demonstrate the existence of synaptic resonance.

The findings are discussed in relation to excitation and inhibition, and also with a view to suggesting use of the limiting frequency as a method of studying the central paths.

Variations in frequency as such can serve as a means of distributing into special channels effects entering a central path containing synapses. (Authors' abstr.)

The Central Excitatory State Associated with Postural Abnormalities.

(1) Rigid muscles (lesion areas) associated with postural abnormalities commonly show spontaneous action potentials.

(2) When such spontaneous activity is absent, it can be induced by suitable stimuli; this is a useful criterion for detecting lesion areas.

(3) Induced reflex activity is probably dependent upon the presence of an enduring C.E.S. plus an accessory subliminal stimulus.

(4) Various unusual types of action potentials occur; these are of doubtful origin.

(Authors' abstr.)

NOVEMBER.

*Absence of Local Sign in Visceral Responses to Pain. *Sattler, D. G.* 417
*Potentials Recorded from the Nerve Trunk and the Dorsal Root by Micro-electrodes. *Parrack, H. O.* 423
*Mediation of Descending Long Spinal Reflex Activity. *Lloyd, D. P. C.* 435
*Intersegmental Inhibition in the Spinal Cord of the Frog. *Winterstein, H., and Terzioglu, M.* 459
*Oscillographic Studies on the Spinal Tract of the Fifth Cranial Nerve. *Harrison, F., and Corbin, K. B.* 465
*Effects of Intensity and Wave Length on Driving Cortical Activity of Monkeys. *Halstead, W. C., Knox, G. W., Woolf, J. I., and Walker, E. A.* 483
*Reflex Discharges in Branches of the Crural Nerve. *Renshaw, B.* 487
*Action Potential and Enzyme Activity in the Electric Organ of *Electrophorus electricus* (Linnaeus). I. Choline Esterase and Respiration. *Nachmansohn, D., et al.* . . . 499

Absence of Local Sign in Visceral Responses to Pain.

A series of experiments, designed to demonstrate localization of a sympathetic response in man following painful stimulation, has been presented. Left and right index finger volume changes, obtained simultaneously, failed to show any difference in amplitude following a unilateral painful stimulus. Skin resistance changes recorded at the same time from the ring fingers bear a similar relationship. Although variations in percentage change or original skin resistance were observed at times, the greater change was not consistently present in the stimulated hand. These experiments indicate that there is no tendency for localization of the responses studied. (Author's abstr.)

Potentials Recorded from the Nerve Trunk and the Dorsal Root by Micro-electrodes.

Micro-electrodes have been used to record potentials from nerve trunks and from dorsal root ganglia.

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(1) The form of the potentials recorded from the nerve trunk by micro-electrodes is the same as that recorded by gross electrodes similarly arranged.

(2) The records are easier to interpret when one micro-electrode is used in combination with a distant diffuse one.

(3) Micro-electrodes whose tip-diameters are greater than 15μ are not sufficiently selective to record single fiber responses from the nerve trunk when large numbers of the fibers are activated synchronously.

(4) Small electrodes (16μ) attentuate potentials arising at a distance far more than do large electrodes (42μ).

(5) The ganglionic potential curve is very complex when recorded by large micro-electrodes within the ganglion. It is composed of waves representing activity of the nerve fibers contained in the ganglion and others representing activity of the cell bodies.

(6) The various phases of the complex wave have been assigned to the various structures, and the alterations in the form of the curve with depth of penetration of the electrode explained.

(7) In a few instances single cell-body potentials have been recorded from the ganglia. This cell-body spike has a greater latency than can be explained by the conduction time in the nerve fiber, and this delay probably represents a slowing of the depolarization wave as it invades the cell body. (Author's abstr.)

Mediation of Descending Long Spinal Reflex Activity.

Some aspects of the transmission of reflex effect from the fore limb to the hind limb have been examined. Such transmission of necessity employs the descending propriospinal neurons, long and short, as a mediate system.

Transmission of activity arising on one side of the body involves propriospinal tracts of both halves of the spinal cord, as a result of the free yoking together of the brachial mechanisms. Free decussation occurs again in the lumbar cord. Consequently unilaterally evoked activity, by transmission through the propriospinal system, excites motoneurons by strictly unilateral paths, by decussating or crossed paths, and also reaches motoneurons of the same side through doubly decussated paths. The lateral columns are more intimately concerned with strictly unilateral transmission. The ventral columns subserve both unilateral and bilateral transmission. No significant functioning in the present experiments can be attributed to the dorsal column.

The first effect exerted in the lumbar cord by a brachial plexus volley is inhibition of some motoneurons of the ipsilateral side through unilateral pathways. The latency of inhibition allows only for conduction and a single synaptic relay in the cervical cord between primary afferent and propriospinal fibers. Hence long propriospinal fibers are involved and the inhibitory effect is a direct action.

Shortly after the onset of inhibition, interneurons of the lumbar enlargement become active and the motoneurons simultaneously are facilitated. At the height of the facilitation period, which lasts *ca.* 35 msec., motoneurons discharge impulses to the periphery. The long spinal reflex discharge is much more variable than short spinal reflexes, but under favourable conditions may approximate or even exceed the latter in size and synchrony.

In the lumbar enlargement the active neuron pools are confined to the ventral half of the cord. The dorsal horns and most, if not all, of the intermediate region remain inactive. In the ventral horn the most powerful activity is encountered in the *nucleus cornu-commissuralis anterior*, indicating the important role played by crossed mechanisms.

A degree of mutual interference takes place between long spinal reflex activity and short spinal reflex activity pertaining to multineuronal paths. This interference is designated as "mutual inhibition," for the deficit is frequently too great to be accounted for as occlusion. On the contrary, long spinal reflexes reinforce one another.

When nuclei are activated by diffuse discharges rather than synchronized volleys, synaptic delay is no longer the determining factor (along with conduction) in central latency. Nuclear delay, usually having several times the duration of the longest known central synaptic delays, becomes a characteristic feature of transmission and accounts for the greater part of central reflex time. (Author's abstr.)

Intersegmental Inhibition in the Spinal Cord of the Frog.

The effect of cooling and of sectioning the spinal cord of the frog when separated from the brain and removed from the body has been investigated.

(1) Prolonged cooling of the spinal cord diminishes or abolishes ipsilateral reflex responses to electrical stimulation of the skin of the foot.

(2) Diminution of reflex activity is often preceded by an increase.

(3) Section of the spinal cord, especially just above the lumbar enlargement, regularly produces a marked increase of reflex response. The threshold strength of current remains unchanged in all three cases.

(4) Cooling subsequent to low dorsal section always depresses reflex activity.

(5) Spontaneous movements, proved to be of reflex origin behave similarly to induced reflexes.

(6) These observations are interpreted as follows: intersegmental inhibitory mechanisms involving the cervico-dorsal segments of the cord are affected by cold earlier than segmental reflex arcs of the lumbar region. Removal of such inhibition by cooling or by cord section increases the magnitude of reflex responses. (Authors' abstr.)

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Oscillographic Studies on the Spinal Tract of the Fifth Cranial Nerve.

By means of the oscillograph, tactile impulses were traced into the spinal tract of the fifth nerve of the cat. Impulses originating in the ophthalmic division of the trigeminal were recorded as far as the caudal part of the first cervical segment, those from the maxillary area as far as the rostral part of the first cervical segment, and those from the mandibular area were followed to the junction of the medulla and cord.

Synchronous action potentials evoked electrically from a large branch of each of the divisions of the fifth nerve were recorded from the spinal tract and traced to approximately the same levels as given above. These potentials were easier to trace than the random tactile responses, but could not be detected an appreciable distance below the levels mentioned. Physiological evidence is presented to support previous anatomical findings regarding the relative position of the three trigeminal divisions within the spinal tract. The ophthalmic fibers assume a ventral position, the mandibular fibers a dorsal position, and the maxillary fibers an intermediate position. Each division remains relatively independent throughout its course.

The action potential evoked electrically consisted of one or two waves, each of which had one or more crests. The first wave was complete within 2 msec. and very likely resulted from activity in first order neurones. The second wave started at about 2 msec., lasted to as long as 4 or 5 msec., and evidenced activity in second or higher order neurones. (Authors' abstr.)

Reflex Discharges in Branches of the Crural Nerve.

The sartorious and the vastus internus are two muscles of different function which are supplied by motor axons originating in the same and adjacent segments of the spinal cord and passing together peripherally in the crural nerve. In a series of cats under pentobarbital sodium anesthesia, reflex discharges were evoked in the motor nerves to each of these muscles by the stimulation of dorsal roots. The discharges had a constancy from preparation to preparation, which stands in contrast with the variability observed in ventral root discharges similarly evoked in comparable preparations.

In spite of the topographical association of the two groups of motoneurons, the reflex discharges in the motor branches supplying the sartorius differed considerably from those in branches to the vastus internus and other components of the quadriceps. Furthermore, the reflex discharges to the two muscles were conditioned in different ways by antecedent stimulation of the same groups of sensory axons. An L6 dorsal root volley evoked in the nerve to the vastus internus a nearly synchronous discharge having a central latency of only 0·9 to 1·6 msec. It evoked in the nerve to the sartorius a dispersed discharge of relatively long central latency. An L7 dorsal root volley produced no conspicuous discharge of vastus internus motoneurons. Its only effect on the discharge produced by an L6 volley was inhibitory. The profound inhibitory effect had a duration as long as several hundred msec. The latency of its onset was brief; it was already present when the conditioning volley arrived at the L6 segment of the cord only 1·0 to 1·1 msec. before the firing of the tested motoneurons. In contrast, an L7 volley produced in the branches to the sartorius a discharge similar to that produced by an L6 volley. The discharge to an L6 volley was facilitated by an L7 volley preceding at intervals up to *ca.* 15 msec. At longer intervals the discharge to the L6 volley was inhibited. (Author's abstr.)

Action Potential and Enzyme Activity in the Electric Organ of Electrophorus electricus (*Linnaeus*) (1) *Choline Esterase and Respiration.*

(1) Voltage, amperage and resistance have been recorded in the electric organ of four specimens of *Electrophorus electricus*, at different sections between head and caudal end. The data were compared with the concentration of Ch.E. at the same segments. V per cm. and QCh.E. run parallel not only in the same fish, but even in fishes of different size in which the E.M.F. of the discharge differs considerably. The experiments offer new evidence for the close relationship between E.M.F. and Ch.E. activity.

(2) The respiration has been measured in different sections of the electric organ with different substrates; glucose, pyruvate, and succinate. With succinate both the succinic oxidizing system and succinic dehydrogenase were examined. In contrast to the great variations of QCh.E. the QO_2 values are practically the same from the head to the caudal end. Even between the strong main organ and the weak bundle of Sachs there is no measurable difference. The oxygen uptake was about the same with all the substrates used.

(3) Histological preparations were made from different sections. The number of electroplaxes in series has been calculated. Photographs of the histological preparations, some of which are reproduced in the paper, demonstrate the different aspect of the voltaic pile. They show that not only the number of electroplaxes per cm. varies, but that there are also great varieties of the aspect of the single electroplax. (Authors' abstr.)

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A Multiphasic Personality Schedule (Minnesota). III: The Measurement of Symptomatic Depression.

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It is concluded that: (1) Significant separation of depressed patients can be demonstrated for a large percentage of cases; (2) patients having only moderate degrees of depressive trend without specific abnormality can be differentiated; (3) depression scores for females are significantly higher than for males and become more so with increasing age; and (4) unselected patients on a psychiatric ward test higher on depression than do patients on other wards.

F. A. MOTE, jun. (Psychol. Abstr.).

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Two Factors in the Prognosis of Alcoholism.

(1) No attempt is made to explain why we partake of alcoholic beverages. The endeavour has been to emphasize the point, however, that consumption of alcoholic beverages is entirely a personal equation.

(2) Since it is a personal equation, some individuals must be subjected to re-education. For those whose education is beginning, the same facts must be brought to their attention. (*a*) The ability to practise self-control is essential. (*b*) The individual must possess a knowledge of his maximum tolerance.

(3) By means of education and re-education along these lines, many fixed ideas may be corrected.

(4) The alcohol susceptibility test is a simple procedure to evaluate an individual's nerve tissue susceptibility to the chemical ethyl alcohol.

(5) Each individual has a maximum tolerance for ethyl alcohol. If he stays within his tolerance, alcoholic beverages will always be serving him, but this requires the presence of the first and foremost factor—the ability to put into practice this knowledge.

(6) The prognosis of the alcoholic patient may be determined by gaining a knowledge of the personality, and by ascertaining whether he is in possession of the ability to enforce self-denial, or self-control. (Author's abstr.)

Contrasting Schizophrenic Patterns in the Graphic Rorschach.

1. The graphic Rorschach technique was applied to 28 mental hospital patients diagnosed as schizophrenic. Certain features of performance were found to be common to a large percentage of the group and a "composite schizophrenic deviation pattern" was decribed.

2. Criteria for good prognosis were isolated which indicated outcome correctly in 23 out of 28 cases. The standard for good prognosis was at least 35 per cent. of "3" ratings, and dominance of blot over concept no greater than a blot-concept quotient of + ·10.

3. The presence of "1" ratings was associated with the presence of hallucinations in 12 out of 13 cases. A small number of other patients also had hallucinations.

4. There was no observable relationship between the presence of delusional ideas and any feature of the graphic Rorschach performance.

5. There was no observable relationship between the presence of single schizophrenic sign or constellation of signs in the verbal Rorschach record and any feature of the graphic Rorschach performance. (Author's abstr.)

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Prognosis of Carbon Monoxide Poisoning in 15 Patients previously Mentally Ill.

(1) A study has been made of 15 mentally ill patients who attempted suicide by motor exhaust gas or illuminating gas. The courses of these patients have been emphasized to aid, in a limited way, in the prognosis of cases of carbon monoxide poisoning.

(2) Four patients who had sufficient gas to cause acute symptoms, but not unconsciousness, developed no sensorium or neurological changes.

(3) Four patients who were unconscious up to 30 minutes developed no changes.

(4) Two patients who were unconscious about one hour developed transient neurological changes. The sensorium of one was intact; cerebral arteriosclerosis complicated the case of the other.

(5) Five patients unconscious anywhere from 3 hours to 10 days showed extreme variability in power of recovery. One, unconscious 10 days, recovered in two months. The speed of recovery is also extremely variable.

(6) A patient poisoned by carbon monoxide is not likely to have serious sequelae if he regains consciousness within one hour after removal from the toxic atmosphere.

(7) Beyond this point, there appears to be no correlation between the duration of unconsciousness and the severity and duration of pathological clinical changes.

(8) There is no important clinical difference between the toxicity of motor exhaust gas and that of illuminating gas. (Author's abstr.)

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The Electroencephalogram and Psychopathological Manifestations in Schizophrenia as Influenced by Drugs.

Mescaline, cocaine, sodium amytal and benzedrine were given to 14 schizophrenic patients, and their influence upon personality functions and the electroencephalogram (EEG) was observed.

Changes in the EEG were found only when definite psychological changes took place.

The effects of the drugs could be classified into two types:

(1) *Those specific for a given drug.* Psychologically these were manifested in changes in attitude, anxiety, mood, etc. Correlated with the most extreme states of anxiety produced by mescaline was a 25 to 30 per cent. increase in frequency of the 10-per-second (alpha) rhythm. With sodium amytal the decreased tension was accompanied by the appearance of a 15 to 20-per-second (beta) rhythm.

(2) *Those characteristic of a given patient.* Psychologically these took the form of elaborations within the content of the psychosis and the patient's reaction to the setting, regardless of which drug was used. Similarly, a change in *per cent. time alpha* of the EEG was consistent in a given patient either in the direction of increase or decrease. (Authors' abstr.)

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QUART. J. STUD. ALCOHOL.

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Requirements for Rorschach Training.

In response to a questionnaire, leading Rorschach workers gave opinions concerning how much training is necessary before an individual may be considered competent to do good Rorschach work. Most workers believe (1) that at least 1–2 years' work are required, including approximately 20–30 hours of theoretical instruction, the rest of the time being devoted to intensive study of actual records under the guidance of a skilled worker; and that a college background with extensive training in either psychology or psychiatry or both is a necessary prerequisite for training in the method. Certain personal qualifications concerning adjustment and sincerity are also made. R. E. Horowitz (Psychol. Abstr.).

SCHWEIZ. ARCH. NEUROL. PSYCHIAT.

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The Present Status of Experimental Knowledge on the Relations of the Diencephalon and Midbrain to Motility. *Bartorelli, C.* 370

Localization of the Vegetative Centers in the Cat's Cerebral Axis by the Method of Electrical Stimulation.

This is a synopsis of Monnier's atlas showing the localization of the central regulating systems in their course from the telencephalon through the medulla. According to the effect of electrical stimulation they are divided into activating and inhibiting centers. The synergic ergotropic

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reactions (cardio-vascular, respiratory, somatomotor, etc.) and similarly the inhibiting and trophotropic reactions are elicited by stimulation of well-defined areas in the different axial segments. In the oral segments, notably the hypothalamus, the areas are organized according to a collective principle, and their activities, ergotropic or trophotropic, are concerned with emotional states. In the peduncle and pons the systems are scattered and intermingled. In the medulla, they reorganize themselves into circumscribed centers, and their action takes on the automatic spinal character. Plates. Extensive bibliography.

M. E. Morse (Psychol. Abstr.).

Z. ANGEW. PSYCHOL.

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The Electrical Processes in the Human Brain.

This is a review of investigations of the electrical processes in the human brain, including also work done on animals. After considering the mass of experimental evidence, the theory is advanced that beta-waves arise from excitation processes in the ganglion cells, while alpha-waves fulfil a vital function for the ganglion cells, a nutritive-vegetative process, which restores their depleted energy. This is considered for its importance in the study of electrical processes, as well as its general psychological importance, as for example in explaining fluctuations of attention. The four chief objections advanced by Berger against this theory are answered in the light of the experimental evidence. D. T. SPOERL (Psychol. Abstr.).

The Origin of the Illusion of Recognition.

Many explanations have been offered of false recognition (déjà vu). Some of the earlier led to metaphysical speculation; others were that it results from reproduction of previous states of being, a similarity between the present and previous situations, a partial recognition, the "free existence" of a feeling, or insufficient functioning of the nervous pathways. An explanation is proposed where the object of false recognition is called the "critical object," which through a series of impressions comes to be "recognized" in the later applied impression as familiar. It is important that the phenomenon occurs most often in a state of weariness or tension where this process of apperception could occur most easily.

D. T. SPOERL (Psychol. Abstr.).

1. Anatomy, Physiology, Biochemistry and Pathology.

The Acetylcholine Theory of Myasthenia: A Critique. Saker, G. [*Klin. Wochschr.*, **20**, 257–9 (1941).]

The theory that myasthenia depends on a disturbance of the chemical stimulus transmission has not been proved. The cause of this disease lies definitely in a metabolic disturbance of the myasthenic musculature itself. RUTH BERGGREN (Chem. Abstr.).

The Role of the Sympathetic Nervous System in the Regulation of the Functional Condition of the Salivary Gland in the Course of Ontogenesis. Kryuchkova, A. P. [*J. Physiol. U.S.S.R.*, **29**, 47–54 (*in English*, 54) (1940).]

In puppies, stimulation of the peripheral end of the sympathicus resulted in qualitative alteration of the saliva. The secretion of the latter was induced by stimulation of the tympanic cord. The content of organic matter increased considerably above that of normal saliva, and ptyalin appeared, although normally it is absent in very young puppies. That these changes were due to the stimulation of the sympathicus was evident from the fact that upon excision of the upper cervical sympathicus ganglion the changes disappeared completely.

C. S. SHAPIRO (Chem. Abstr.).

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Respiration of the Developing Brain. Tyler, D. B., and van Harreveld, A. [*Am. J. Physiol.*, **136**, 600–3 (1942).]

The O consumption and glucose utilization of excised rat brain were determined at different ages. Three distinct levels in the respiration of the brain can be distinguished. The lowest level, which occurs during the first week of life, is characterized by a low O and glucose utilization but a high glycolytic activity. The highest level occurs between the 4th and 7th week and is characterized by a high glucose and O utilization but a decrease in glycolytic activity. The adult level is reached at about the 20th week and is somewhat lower than the 2nd level. At birth the medulla has the highest respiration, followed by stem and pallium; in the adult this order is reversed. E. D. WALTER (Chem. Abstr.).

Effect of Diagnostic Treatment on Metabolism of Brain. Gorodisskaya, H. Ya. [*Biochem. J.* (*Ukraine*), **17**, 105–13 (1941).]

In dogs and cats, cisternal puncture alters the N metabolism of the brain, increasing the residual N content. Bilateral trephining increases the content of non-albumin N.

B. C. P. A. (Chem. Abstr.).

Alteration of the Amino Acid Composition of the Brain Protein in Relation to the Age of Man. Dobrynina, V. [*J. Physiol. U.S.S.R.*, **29**, 220–4 (*in English*, 223–4) (1940).]

Analyses were made of brains from subjects who had died of trauma, not from disease, for tryptophane, tyrosine, cystine, arginine, histidine and lysine. The ages were from infancy to 65 years. Tryptophane decreases gradually with age; cystine increases from infancy to 9 years, then remains constant. Arginine reaches a maximum at 9, and drops slightly afterwards; cystine of the cerebellum increases considerably between infancy and 9 years. The cystine and lysine contents of the cerebellum differ sharply from those of the hemispheres in all age groups studied. C. S. SHAPIRO (Chem. Abstr.).

Production of Goiter and Myxedema by Thiocyanates. Kobacker, J. Lester. [*Ohio State Med. J.*, **38**, 541–2 (1942).] RUTH BERGGREN (Chem Abstr.).

Clinical Investigations on Beriberi (III). The So-called Subclinical Deficiency of Aneurine (Vitamin B_1). Meyers, F. M. [*Geneeskund. Tijdschr. Nederland.-Indië*, **80**, 1727–46 (1940); *Trop. Diseases Bull.*, **38**, 602–3 (1941).]

Descriptions of subclinical aneurine deficiencies from the temperate parts of the world show a much wider range of symptoms than those of the tropics. This difference in symptoms is believed to arise from different conditions of disease. In the Netherlands East Indies at least aneurine deficiencies are relatively uncomplicated and chiefly of exogenous origin. In Europe and in the U.S. these subclinical deficiencies are often conditioned by alcoholism and chronic diseases of the intestinal tract and are mixed furthermore with pellagra in its *forme fruste*. In a number of healthy Javanese estate-laborers the daily excretion of aneurine in the urine varied from 0 to 63γ, with an excretion after subcutaneous injection of aneurine test doses of 2–50 per cent. (in most cases, 10–30 per cent.). However, one healthy "prepared" person (i.e., a person who had received a diet rich in aneurine) showed excretion values of the same order as those of patients with mild beriberi. In 9 out of 14 healthy persons, a definite diuretic influence of the test doses of aneurine could be established. There was no clear correlation with the aneurine excretion values. Aneurine has properties of a true diuretic. In 3 out of 8 healthy individuals, the increase of systolic blood pressure after adrenaline became much stronger after the test doses with aneurine had been given. The same occurred in the cases of beriberi, but in none of the three "prepared" individuals. This vascular reaction proved to be a valuable means in establishing conditions of aneurine deficiency when other means had failed, but no definite correlation could be detected with the excretion of aneurine in the urine. The reaction seems to be a consequence of an unbalanced vascular tonus; with repeated injections of adrenaline and before the test doses had been given, the rise in blood pressure became much stronger, as was the case in the persons with a negative vascular reaction. The excretion of aneurine in the urine alone often does not seem to produce figures that are sufficiently unequivocal to judge whether or not in individual cases a deficiency is present. RUTH BERGGREN (Chem. Abstr.).

Studies in Pellagra: Preliminary Note. Díaz-Rubio, M. [*Rev. clin. espan.*, **2**, 161–2 (1941); *Trop. Diseases Bull.*, **38**, 716 (1941).]

The etiology of pellagra is discussed. From 1936 to 1939 the food supply in Madrid was grossly deficient in quality and quantity. "Para-pellagrous" states, characterized particularly by lesions of the nervous system, were commonly seen in Madrid. Other deficiency conditions were famine edema, hemeralopia, hyperkeratosis and anemias, while minor degrees of scurvy were present. Although the diet was deficient in vitamin B_1, there was no beriberi.

RUTH BERGGREN (Chem. Abstr.).

The Role of the Neuroglia in Cholesterol Metabolism. Gorizontov, P. D. [*Bull. biol. méd. exptl. U.R.S.S.*, **5**, 356–9 (1938); *Chem. Zentr.* (**11**), 88 (1940); *cf. C. A.*, **34**, 5158[8].]

In the meningo-encephalitis experimentally produced in dogs by subdural injection of turpentine or $AgNO_3$ a condition of hypercholesterolemia developed. Histochemical findings

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indicated that this was due to an increased cholesterol synthesis taking place in the neuroglial tissue of the brain and was not connected with cytolytic processes in the subcutaneous connective tissue. The hypercholesterolemia appearing in various cases of poisoning (by P, As, etc.), in progressive paralysis and in multiple sclerosis is probably due to an increased rate of synthesis of cholesterol and an increased rate of its discharge from the brain into the blood.

M. G. Moore (Chem. Abstr.).

Release of Potassium by the Brain of the Dog during Electrical Stimulation. Cicardo, V. H., and Torino, A. [*Science*, **95**, 625 (1942).]

Electrical excitation of the brain of spinal or curarized dogs, in which there are no general contractions, produces an increase of K in the blood of the superior longitudinal venous sinus. This increase in plasma K is not accompanied by a similar increase of K in blood drawn simultaneously from the femoral artery. Felix Saunders (Chem. Abstr.).

The Decomposition of Proteins from the Cortical Substance of Brain by Human Blood Serum. Inoue, Itiro, and Kanai, Tutomu. [*Zyuzenkai Zassi* (*J. Perfect Health*), **45**, 962–72 (1940); *Japan. J. Med. Sci.* (**11**), *Biochem.*, 4, *No.* 4, *Abstracts* (*in English*), 108 (1941).]

In about 40 per cent. of healthy persons the blood serum was able to hydrolyze the protein from the cortical substance of brain. The hydrolysis was inhibited by heating and change in pH. C. L. B. (Chem. Abstr.).

Polyneuropathy in Thiamine-deficient Rats Delayed by Alcohol or Whisky. Lowry, J. V., Sebrell, W. H., Daft, F. S., and Ashburn, L. L. [*J. Nutrition*, **24**, 73–83 (1942).]

In paired feeding experiments with a thiamine-deficient diet, 54 rats on water without exception developed polyneuropathy before the paired litter mates on EtOH or whisky. Both EtOH and whisky delayed the onset of polyneuropathy. The explanation is not clear, and the data do not support the assumption that the ingestion of alcohol increases the thiamine requirement. Further experiments showed that the polyneuropathy observed was related to the thiamine deficiency, and could be prevented or alleviated by the administration of thiamine regardless of the presence or absence of EtOH or whisky. C. R. Fellers (Chem. Abstr.).

Alcoholic Encephalopathy in Man and Fish-diet Disease in Foxes: A Study in Comparative Neuropathology. Alexander, Leo., Green, Robert G., Evans, C. A., and Wolf, Louis E. [*Trans. Am. Neurol. Assoc.*, **67**, 119–22 (1941).]

Wernicke's encephalopathy in human alcoholic patients is clinically and pathologically identical with the thiamine deficiency disease produced in foxes by a large amount of raw fish. The thiamine requirement is greatly increased by the fish diet if the thiamine and fish are given simultaneously, but not if the thiamine and fish are given 12 hours apart. This suggests that the fish contains a factor directly destructive to thiamine. The possibility that alcohol may have a similar effect is of interest in view of the consideration of addition of vitamin B_1 to alcoholic beverages. Marion Horn (Chem. Abstr.).

Clinical and Chemical Studies in Wernicke's Syndrome. Wortis, Herman, Jolliffe, Norman, Stein, Martin H., and Bueding, Ernest. [*Trans. Am. Neurol. Assoc.*, **67**, 115–18 (1941).]

Observations on 31 cases of Wernicke's syndrome led the authors to conclude that this syndrome is invariably associated with a thiamine deficiency, apparently related to the ophthalmoplegia, and in some cases to the marked disturbances in consciousness and mental functioning. Other deficiency syndromes (pellagra, nicotinic acid deficiency, encephalopathy, riboflavin deficiency) may superimpose themselves on the more usual Wernicke picture, and these require specific treatment. The development of ophthalmoplegia may be prevented by early administration of thiamine in patients showing delirium with marked increase in psychomotor activity (which usually precede the development of this syndrome). Among the first 27 cases, all receiving "adequate vitamin therapy" recovered, unless a fatal complicating condition (pneumonia, hepatitis) was present. The recovered cases, however, usually developed a Korsakoff syndrome which did not consistently respond to thiamine. Of the last four cases, in which detailed chemical studies were made, all recovered after thiamine therapy but were left with a residual Korsakoff syndrome. The chemical studies in the last four cases showed that in Wernicke's syndrome the blood pyruvate during fasting is elevated, and the pyruvic acid curve following glucose ingestion is abnormally high, with a delay in return to the fasting level. After thiamine therapy, these metabolic abnormalities tended to disappear at the same time as improvement occurred in the ophthalmoplegia and the mental status. Marion Horn (Chem. Abstr.).

Does Colamine Occur Free in the Brain? Müller, Ernst. [*Z. Biol.* **100**, 49–50 (1940); *Chem. Zentr.* (**1**), 3942 (1940).]

While choline is widely distributed in animal and plant tissues as a building unit of phosphatides, colamine as a building unit of the cephalins has not yet been found free. The brain, which is rich in cephalin, was examined to determine its content in colamine. The aqueous extracts from 69 fresh human brains were concentrated in vacuo under CO_2. Further treatment of the extracts, which is given in the original, resulted in the detection of choline. Attempts to precipitate colamine with Reinecke salt were negative. The absence of colamine in the tissues

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obviously is due to its rapid decomposition. It is also possible that for the formation of the colamine portion of the cephalin molecule a demethylization of lecithin takes place, or that a splitting off of colamine takes place simultaneously with a methylization of choline.

M. G. MOORE (Chem. Abstr.).

The Presence of Free Colamine in the Brain. Müller, Ernst. [*Z. Biol.*, **100**, 249–50 (1940).]

Choline phosphotungstate is 10-fold more soluble in 5 per cent. H_2SO_4 than is colamine phosphotungstate. With this in view, the filtrates from the previous analyses (*C.A.*, **36**, 4880[8]) were purified and reprecipitated with 2 $(H_3PO_4)_2$ WO_3 in a 5 per cent. H_2SO_4 solution. The voluminous precipitate was treated as essentially as before. Alcohol picrolonate was used for separation and then the colamine was precipitated as Au salt. This was recrystallized from HCl. A total of 3·5 mgm. of free colamine was found per kgm. of brain. Total choline was 68·4 mgm. per kgm. of brain. Details of the method of analysis are given.

M. HOSEH (Chem. Abstr.).

Nerve Regulation by the Thyroid Gland. Asher, L., and Ruetsch, Fr. [*Z. Biol.*, **100**, 1–7 (1940).]

The threshold value of adrenaline to produce a temperature rise was determined on normal rabbits. The temperature was measured with a Cu-Cu constantan thermo-element made of 0·13 mm. wire and soldered with Au solder. The averages from a large number of experiments show that the smallest threshold value, i.e., the greatest susceptibility to adrenaline, is found in normal animals (1 : 80 million); the value rises for animals whose sympathic nerve is severed (1 : 70 million), and attains the maximum in animals whose thyroid gland is removed completely (1 : 50 million).

M. HOSEH (Chem. Abstr.).

Formation of Phospholipide in vitro by Brain and Nerve with Radio-active Phosphorus as Indicator. Fries, B. A., Schachner, H., and Chaikoff, I. L. [*J. Biol. Chem.*, **144**, 59–66 (1942).]

The formation of phospholipide from Na_2HPO_4 containing radioactive P by excised brain of young and old rats and dog sciatic nerve *in vitro* was demonstrated. Brain slices formed phospholipide at 3–5 times the rate of the brain homogenate. Brain from 15 gm. rats formed phospholipide faster than brain from 50–200 gm. rats, but the significance of this is uncertain, since the rate of penetration of Na_2HPO_4 into the different kinds of brain slices was not determined.

L. E. GILSON (Chem. Abstr.).

Effect of the Puncture of Medulla Oblongata upon the Cytochrome Content of Organs. Kono, Makoto. [*Zikken Syokakibyogaku* (*Exptl. Gastroenterol.*), **15**, 319–24 (1940); *Japan. J. Med. Sci.* (**11**), *Biochem.* 4, *No.* 4, *Abstracts* (*in English*) **103** (1941).]

Cytochrome was decreased in liver, kidney and heart as a result of the puncture of nucleus motorius dorsalis n. vagi. The decrease was noticeable one hour after the operation, and a minimum was reached after 24 hours. The normal value was reattained in five days. This decrement of the cytochrome content was greatest in the liver, least in the heart.

C. L. B. (Chem. Abstr.).

The Nerve Trauma and its Consequences. Pigalev, I. A. [*J. Physiol. U.S.S.R.*, **29**, 255–64 (1940).]

Trauma of the great sciatic nerve increased the chloride content of the saliva secreted by the parotid gland in the same side as the trauma, unless the degree of stimulation was sufficient to produce severe pain; then the chlorides decreased. Chronic stimulation of this nerve (in dogs) caused an impairment of the excretory function of the kidneys on the same side as the trauma. Injection of Tl salts into this nerve (in rabbits) caused loss of hair on the same side, and formation of ulcers four months after the trauma on soles of the feet, deformation of joints and loss of one or more phalanges. Stimulation of the trigeminus caused formation of ulcers not only on the same side, but also in remote places of the body. Strychnine produced ulcers six months later on all limbs, and destruction of bones in the fore limbs. This was especially severe on the same side on which injection was made. In narcotized rabbits stimulation of the great sciatic nerve for ten minutes with an electric current produced an increase of lactic acid in the brain hemisphere of the side on which the trauma occurred. When the nerve was severed, the lactic acid of the brain increased during the first few days, then passed through the normal value and decreased to a minute, after which it was restored to normal. The total period of observation was 30 days. Arsenic given intravenously at the same time with the nerve stimulation was absorbed by the brain in a quantity greater than normal. The hemisphere from the same side where the nerve was stimulated contained less As than that from the normal side.

C. S. SHAPIRO (Chem. Abstr.).

Acetylcholine in Various Vascular Regions during Reflex Activity of the Vegetative Nervous System. Alpern, D. E., and Fesenko, T. E. [*J. Physiol. U.S.S.R.*, **29**, 249–54 (*in English*, 254) (1940).]

Excitation of the vagus during the oculocardiac reflex leads to changes in acetylcholine content in different regions of the vascular system. In the sinus the acetylcholine concentration is higher than in blood from arteries or veins, hence this substance is liberated by the central

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nervous system; it is formed in the synapses of the central nervous system. Arterial blood contains more of it than the veins, owing to the fact that the site of maximum liberation is the left heart. The hepatic vein contains less acetylcholine than the femoral artery or vein. The cholinesterase content increases only slightly in the peripheral vascular bed, but rises considerably in the sinus; thus accumulation of this substance is associated with its increased breakdown.
C. S. SHAPIRO (Chem. Abstr.).

Acetylcholine in Human Cerebrospinal Fluid. Brecht, K. [*Klin. Wochschr.*, **19**, 1087 (1940); *Chem. Zentr.* (1), 791 (1941); *cf. C.A.*, **35**, 1466[3]; **36**, 5875[6].]
In the cerebrospinal fluid of patients with tubercular and meningococcus meningitis and with epilepsy, acetylcholine was detected in concentrations of $1 : 10^{9}$–$1 : 10^{16}$, using as test material the lung preparation of winter frogs in accordance with the method of Brecht, Carsten and Sullies.
M. G. MOORE (Chem. Abstr.).

Aneurine in the Cerebrospinal Fluid. Kasahara, Mitio, and Mori, Humio. [*Klin. Wochschr.*, **19**, 631 (1940); *cf. C.A.*, **32**, 9200[1].]
The cerebrospinal fluid of normal rabbits contained 0·0125–0·0220 mgm. per cent. aneurine. Vitamin B_1 injected intravenously into normal rabbits passed into the cerebrospinal fluid.
RUTH BERGGREN (Chem. Abstr.).

The Sodium Chloride Content of the Cerebrospinal Fluid at Different Stages of Insufficient Blood Circulation. Aviosor, M. L. [*J. méd. Ukraine*, **10**, 1329–39 (*Russian and German summaries*) (1940); *cf. C.A.*, **33**, 6431[5], 8765[8].]
In circulatory disturbances the Cl concentration in the cerebrospinal fluid increases. This increase in Cl is greater the more pronounced the circulatory disturbance. The only exception was the 3rd (irreversible) stage, in which the NaCl content was relatively diminished compared with the preceding stage. An attempt is made to explain the above increase in NaCl by a retention of Cl in the organism. Since such a retention has been demonstrated for tissue and edema fluids, with which the cerebrospinal fluid possesses analogous properties, it can also be assumed for the latter. Moreover, in the increase of the NaCl content of the cerebrospinal fluid, the venous stagnation in the entire organism, including the central nervous system, probably also plays a role. This stagnation leads to passage of fluid from the dilated, poorly nourished walls of the vessels to the cerebrospinal fluid system; it can favor a subsequent transition of NaCl into the cerebrospinal fluid. The above exception to the general rule can be ascribed to the influence of a prolonged saltless regimen, and in the 3rd stage to the effect of the disturbance of the blood-brain barrier.
RUTH BERGGREN (Chem. Abstr.).

The Protein of the Cerebrospinal Fluid in Patients with Chronic Alcoholism. Trowbridge, Ellsworth H., jun., and Secunda, Lazarus. [*New Engl. J. Med.*, **226**, 195–7 [1942].]
The protein content of the cerebrospinal fluid was greater than 45 mgm. per cent. in 20 per cent. of 641 patients with chronic alcoholism. The abnormally high concentrations were more than twice as frequent as in a series of control patients. The concentration was not influenced by the duration and number of previous attacks of alcohol psychosis or by the presence of polyneuritis.
E. R. MAIN (Chem. Abstr.).

An Electrophoretic Study of the Protein Components in Cerebrospinal Fluid and their Relationship to the Serum Proteins. Kabat, Elvin A., Moore, Dan H., and Landow, Harold. [*J. Clin. Investigation*, **21**, 571–7 (1942).]
The electrophoretic pattern of cerebrospinal fluid resembles that of serum. Alterations in the composition of the protein of the serum are reflected in the spinal fluid, but the changes are not as marked. An exception is found in neurosyphilis. Colloidal gold activity is associated with the γ globulin fraction, and albumin has an inhibiting effect on the colloidal gold reaction.
J. B. BROWN (Chem. Abstr.).

The Value of the Cerebrospinal Fluid Examination in the Diagnosis of Intracranial Tumors. Bligaard, Karen. [*Acta Psychiat. Neurol.*, **16**, 111–42 (1941).]
In 400 cases of intracranial tumors, 66 per cent. showed increased albumin in the spinal fluid, and in 80 per cent. the pressure was increased. The cell count was normal in 92 per cent.
M. L. C. BERNHEIM (Chem. Abstr.).

Microdetermination of Bromine in Cerebrospinal Fluid. Hardwick, P. J. [*Analyst*, **67**, 223–5 (1942).]
In case of suspected poisoning by CH_3Br, a determination of total Br in a small sample of cerebrospinal fluid was required. To prevent loss of Br, the sample was first saponified by the method of Francis and Harvey (*C.A.*, **28**, 1374[3]). Then, after numerous experiments with different procedures in test experiments with 0–20 mgm. of KBr added to 17 mgm. NaCl, it was found that the fluorescein and iodometric methods of Doering (*C.A.*, **31**, 3820[6]) gave satisfactory results in the determination of Br in the presence of Cl. Detailed directions are given for carrying out both procedures.
W. T. H. (Chem. Abstr.).

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Sodium Hypobromite Azotometric Research on Cerebrospinal Fluid. Oi, Masaomi. [*Zyuzenkai Zassi* (*J. Perfect Health*), **45**, 789–97 (1940); *Japan. J. Med. Sci.* (**11**), *Biochem.*, 4, *No.* 4, *Abstracts* (*in English*) (111) (1941).]

In four cases of tuberculosis the hypobromite coefficient of cerebrospinal fluid was strikingly lower than in normal persons. C. L. B. (Chem. Abstr.).

Chemical Control of Nerve Tension used by Graduate Students. Gardner, T. S. [*J. Tenn. Acad. Sci.*, **16**, 290–2 (1941).]

Benzedrine sulfate was found to give increased mental acuteness in graduate students. The dose should not exceed 10 mgm., and 2·5 mgm. is usually effective. Overdosing makes relaxing very difficult. About 1½ hours is required for the effect to appear. Relaxation is assisted by the use of a sedative just before retiring. Benzedrine sulfate taken by the use of an inhaler has some effect, and should not be used habitually because of the effect on the heart.

A. Lloyd Taylor (Chem. Abstr.).

Lead Encephalopathy in a Chinese Infant. Kian, Loe Ping. [*Geneeskund. Tijdschr. Nederland.-Indië*, **81**, 1667–73 (1941) (*English summary*); *Trop. Diseases Bull.*, **39**, 198–9 (1942).]

A case is reported of a 7-month-old child who was suffering from plumbism as a result of the ingestion of a preparation known locally as "Yok-san-merah," which has been applied by the mother to the buccal and lingual mucosa to prevent aphthae. This preparation is a red powder which contains both Pb and Hg; one of the constituents is "tjoeseh" or HgS (cinnabar). This preparation is a popular household remedy among the Chinese in Java.

Ruth Berggren (Chem. Abstr.).

Effect of Carbon Dioxide on the Spinal Cord of the Frog. Leuken, B. [*Z. Biol.*, **100**, 373–93 (1940).]

The effects of CO_2-air mixtures containing 5, 10, 15, 20, 30, 50 and 100 per cent. of CO_2 were studied. The results were recorded as curves of intensity of stimulus *vs.* intensity of response and intensity of stimulus *vs.* interval of response. M. Hoseh (Chem. Abstr.).

Thiamine Deficiency and Chastek Paralysis in Foxes. Hodson, Adrian Z., and Smith, Sedgwick E. [*Cornell Vet.*, **32**, 280–5 (1942).]

The clinical symptoms of anorexia, weakness, ataxia, spasms and lowering of the body temperature were observed in foxes fed a thiamine-deficient diet. These symptoms are apparently identical with those of foxes suffering from Chastek paralysis as a result of feeding an adequate diet with added uncooked fish (smelt). Both conditions were cured completely with thiamine chloride. Chastek paralysis was not cured by pyridoxine, riboflavin or Ca pantothenate. K. D. Jacob (Chem. Abstr.).

Pulmonary Cerebral Effect Time as Determined by Amyl Nitrate. (1) *Establishment of a Normal Range. Uhley, M. H.* [*J. Lab. Clin. Med.*, **27**, 1111–16 (1942).]

A simple method for quantitating pulmonary cerebral effect time is described which involves the inhalation of $AmNO_2$ by the subject and the detection of the drug action on the vessels of the head. The $AmNO_2$ is placed in a special inhaler that is constructed from $\frac{1}{8}$ in. A1 tubing. After a normal expiration, the subject inhales slowly and deeply from the inhaler (usually for two seconds). The starting time of the test is the time at the end of the inhalation, and the end point is the time of a prearranged signal given when the subject experiences a slight dizziness or fullness in the head. This test measures the effective pulmonary ventilation, the circulation time of the left side of the heart, and is affected by variations in the reaction time of the subject. Measurements made on 100 persons selected at random gave an average value of 12 seconds, with most of the values within the range 10–16 seconds. The advantages and the limitations of the method are discussed. Howard W. Robinson (Chem. Abstr.).

Cerebral Metabolism in Fat-fed Dogs. Mulder, Arthur G., and Crandall, Lathan A., jun. [*Am. J. Physiol.*, **137**, 436–9 (1942); *cf. C.A.*, **35**, 498.[8]]

The brain of the dog which has been fed fat for a sufficient time not only to develop ketosis but to become habituated to the ketotic state does not burn acetone bodies. The brain of the fat-fed dog has an R.Q. of approximately 1·0. The amounts of O and glucose removed by brain during the ketotic state are not significantly different, in terms of mgm. per 100 ml. of blood, from those removed by the brain tissue of normally fed dogs.

E. D. Walter (Chem. Abstr.).

The Vitamin C Content of the Blood Serum in Various Psychoses and its Change after Administration of the Vitamin. Nilsson, Per. [*Nord. Med.* (**1**), 600–3 (1939); *Chem. Zentr.* (**1**), 793 (1941).]

In tests made on 100 mentally diseased persons either no vitamin C or very little of the vitamin was found in the blood serum. The values found for 21 normal individuals were likewise very low. After administration of the vitamin (300 mgm. in 12 days), the same type of curves of the vitamin C level were obtained for normal individuals and for manic-depressed individuals; the curves obtained for individuals suffering from dementia praecox were steep with maximum about twice as great as those of the curves just mentioned.

M. G. Moore (Chem. Abstr.).

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The Histochemical Determination and Localization of Vitamin C in the Central Nervous System. Wolf-Heidegger, Gerhard. [*Confinia Neurol.*, **4**, 121–47 (1942).]

The distribution of ascorbic acid (I) in the different structures and in the cells of the brain was determined in guinea-pigs and rats with the histochemical method of Giroud and Leblond (*C.A.*, **29**, 7414[4]): reduction of intravenously injected $AgNO_3$ by (I). Ag granules, indicating the presence of (I), were found in nerve cells of the various types in all brain regions of normal animals. In scorbutic guinea-pigs no (I) was found. Ag granules were seen only in the cell plasma, never in the nucleus. Peripheral nerves gave no (I) reaction.

WARREN M. SPERRY (Chem. Abstr.).]

Blood-Brain Barrier. Friedemann, Ulrich. [*Physiol. Rev.*, **22**, 125–45 (1942).]

The barrier which exists between the brain and blood is localized in the central nervous system capillaries which possess selective permeability. Experiments made with aniline dyes, toxins, viruses, antibodies and drugs to determine the capillary permeability indicate that this is governed by the electrochemical properties, the cerebral capillaries being permeable to substances with a positive or no charge (basic dyes, cobra venom) at the pH of the blood but impermeable to substances with a negative charge (acid dyes, toxins). The capillary system as a whole is more permeable to electropositive than to electronegative substances. The toxicity, however, seems to be more directly correlated with the electrokinetic potential than with the sign of the charge. The permeability of cerebral capillaries may be increased under pathological conditions, also under the influence of theophylline, adrenaline and testicular extracts.

S. MORGULIS (Chem. Abstr.).

Anaphylactogenic Properties of Normal and Virus-infected Brains, with Special Reference to Neurokeratin. Bailey, G. Howard, and Gardner, Raymond E. [*Am. J. Hyg.*, **36d**, 205–15 (1942).]

The tissue-specific, water-soluble anaphylactogen found in autoclaved aqueous extracts of brain, particularly in the white matter, is derived from neurokeratin. Purified preparations of the white matter of brain were made by prolonged and repeated extraction with acetone, abstract alcohol and ether until there remained no substance soluble in these chemicals or in chloroform or benzene. The lipoid extracts of white matter gave no anaphylactic action. Guinea-pigs passively sensitized with anti-brain-broth rabbit serum, when injected with the heated aqueous extracts of the residual purified brain matter, gave positive anaphylactic shock. These extracts were active after being twice autoclaved in distilled water in H-ion concentration between pH 6·7 and 7·8, but not at neutrality. The anaphylactogen is more active at pH 7·2 to 7·8 than at pH 6·7 to 7·0. Glycerol seemed to inactivate the antigen. Autoclaving an infusion of whole brain may destroy the anaphylactogen, but this is not true of the purified preparation, especially at the high pH. The specific substance is present in autoclaved extracts of neurokeratin after digestion with pepsin, but is absent after digestion with trypsin. The anaphylactogen was present in the brains of several animal species in various stages of autolysis and in the brains of animals infected with the neuroviruses (rabies, neurovaccinia, equine encephalomyelitis, eastern but not western strain), as shown by positive anaphylactic tests.

MARY S. SHORB (Chem. Abstr.).

Eastern Equine Encephalomyelitis. VI: Facilitation of Infection in the Mouse. King, Lester S. [*J. Exptl. Med.*, **76**, 325–34 (1942); *ibid.*, **71**, 59; **72**, 573 (1940).]

Glycerol (50 per cent.) injected intraperitoneally, intramuscularly or intravenously greatly enhances the activity of equine encephalomyelitis virus injected intramuscularly, increasing its virulence up to 100-fold. The same effect is produced by very concentrated NaCl. The results appear due to dehydration of the nervous system, suddenly produced. Gradual withdrawal of body fluids, produced by depriving animals of drinking water, results in sharp concentration of the blood, equal to that produced by glycerol or salt; but such deprivation of water alone does not result in significant dehydration of the brain, nor does it have any effect on virus action. The facilitation effect is not produced by drastic procedures involving shifts of electrolytes without loss of total water from the brain. The fact that glycerol has no facilitating action when the virus is administered intranasally or intraocularly suggests a fundamental difference in pathogenesis between these routes and the intramuscular.

C. J. WEST (Chem. Abstr.).

Investigations on the Changes in the Acetylcholine Content of the Central Nervous System of the Rabbit under Strong Stimulation by Strychnine and Tetanus Toxin. Fegler, J., and Leluss-Lachowicz, Z. [*Acta Biol. Exptl. (Warsaw)*, **13**, 69–88 (1939); *Chem. Zentr.* (**11**), 3052 (1940).]

The administration of strychnine to rabbits produced a decrease in the total acetylcholine (I) content and a relative increase in the content of free (I) in the central nervous system. Tetanus toxin increased the total (I) and decreased the relative amount of free (I). The (I) which is fixed in the central nervous system therefore is reduced by strychnine and increased by tetanus toxin. The reduction in (I) produced by strychnine disappeared after the stage of excitation had been passed. With the tetanus toxin, however, the content of (I) continued to increase with increased poisoning. The breathing of O_2 checked the reduction in (I) in strychnine poisoning.

M. G. MOORE (Chem. Abstr.).

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Sleep after Injection of Calcium Chloride into the Hypothalamus. Tonkikh, A. V. [*J. Physiol. U.S.S.R.*, **30**, 191–4 (*in German*, 194) (1941).]

CaCl injected in small doses into the hypothalamus or into the brain ventricle induces in cats a sleep that differs from the sleep induced by electric stimulation of these regions. Injection of CaCl is effective both on normal cats and those with severed sympathetic innervation. The sleep induced in both cases resembles in all particulars a sleep under narcosis.

C. S. SHAPIRO (Chem. Abstr.).

The Metabolic Effects of Potassium, Temperature, Methylene Blue and p-Phenylenediamine on Infant and Adult Brain. Himwich, Harold E., Bernstein, Albion O., Fazekas, Joseph F., Herrlich, Herman C., and Rich, Edith. [*Am. J. Physiol.*, **137**, 327–30 (1942).]

The cerebral tissues of rats of various ages exhibit differences in the response to metabolic stimulants. The O uptake of the infant brain is accelerated to a lesser degree by K, increases of temperature and p-phenylenediamine, and the decolorization time of methylene blue is delayed. The smaller response to K and increase of temperature in the young may be ascribed to a general effect on all enzymes which are of lesser concentration in the newborn, while the slower utilization of p-phenylenediamine and the delayed decolorization time of methylene blue may be accounted for by smaller concentrations of cytochrome oxidase and glucose dehydrogenase respectively.

E. D. WALTER (Chem. Abstr.).

The Phosphorus Content of the Brain during B_1 Avitaminosis. Boldyreva, N. V. [*J. Physiol. U.S.S.R.*, **29**, 582–8 (*in German*, 588) (1940); *cf. C.A.*, **34**, 5132.]

Normal pigeon brains and those from B_1-avitaminized birds were analyzed for total P, inorganic P, creatine phosphate, P hydrolyzate (with 1 N HCl for 7, 30 and 180 minutes), nonhydrolyzable (after 3 hours) P, orthophosphoric acid, acid-soluble P, lipide P, protein P and total dry matter. Creatine phosphate was determined by calculating the difference between inorganic P and total orthophosphoric acid. Most of the above constituents were also determined in the lobi optici and cerebellum of normal and avitaminized pigeons. The same analyses were done on another series of birds that was kept under hunger conditions. Of these one group received vitamin B_1 and water and the other was in a state of a natural B_1 deficiency, owing to lack of food. This type of avitaminosis was compared to that produced by feeding autoclaved rice. In the cerebral hemispheres, lobi optici and cerebellum the total P, protein P, lipide P and acid-soluble P were present in equal amounts in normal and B_1-deficient birds, B_1 avitaminosis produced an increase of inorganic P, nonhydrolyzable P and creatine phosphate in the hemispheres. Accordingly, the 7-, 30- and 180-minute hydrolyzates decreased, but not in the same proportion. The most pronounced fall was in the 30-minute fraction, which was mostly phosphopyruvic and hexose-diphosphoric acids. The 7-minute fraction, consisting chiefly of adenylpyrophosphoric acid, also decreased considerably, the rate of fall being higher than the rate of creatine phosphate increase. Under fasting conditions the lobi optici and cerebellum of the birds receiving vitamin B_1 and water showed no change as compared with the normal cases. The hemispheres gave a considerable increase of nonhydrolyzable P and a slight rise in creatine phosphate. The 30- and 180-minute hydrolyzates were decreased, but the 7-minute fraction showed no change. The lipide P decreased, while the acid-soluble P increased. In complete fasting natural B_1 avitaminosis produced no changes in the lobi optici and cerebellum. In the hemispheres the total P rose and the 7-minute hydrolyzate fell. The concentration of other P fractions were the same as in the normal hemispheres. This included the 30-minute hydrolyzate, which, contrary to autoclaved rice avitaminosis, remained equal to that of the normal brain. It can be concluded that in B_1 avitaminosis the increase in inorganic P is due chiefly to the formation of hydrolysis products, especially the decomposition of adenylpyrophosphoric acid. The increase in creatine phosphate and decrease in adenylpyrophosphate, as well as of phosphopyruvic and hexosephosphoric acid in B_1 avitaminosis, indicate impaired carbohydrate metabolism as a result of this deficiency.

C. S. SHAPIRO (Chem. Abstr.).

Anatomic Changes of the Peripheral Nerves due to Interference with Nutrition Equilibrium caused by a Predominantly Fat or Protein Diet. Bertrand, Ivan, and Lecoq, Raoul. [*Compt. rend.*, **211**, 306–8 (1940).]

F. H. RATHMANN (Chem. Abstr.).

The Vegetative Cutaneous Reflexes and the Effect of Electrolytes. Shirokii, V. F. [*J. Physiol. U.S.S.R.*, **29**, 165–72 (*in English*, 172) (1940).]

Intracutaneous injection of NaCl, KCl, CaCl and MgCl in isotonic or hypertonic solutions affects the vegetative nerves of the heart and the nictitating membrane of cats, as shown by alteration of excitability of the peripheral end of the cardiac vagus under action of induction current. The tonus of the sympathetic nervous system is augmented by all the above electrolytes in the isotonic concentrations. In addition 0·85 per cent. NaCl solution simultaneously increases the tonus of the parasympathetic nervous system in practically all cases. An isotonic (1 per cent.) KCl solution increases the tonus of the latter in 70 per cent. of the cases, a 2·8 per cent. CaCl solution in 30 per cent. of the cases, and a 2·5 per cent. MgCl solution in only a few cases. In the remaining cases K, Mg and Ca ions lower the tonus of the parasympathetic system, while increasing that of the sympathetic nerve-tonus, accompanied by a lowering of the tonus

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of the parasympathetic system. The narcotic used and the species of the animal affect the results. The specificity of the electrolyte action was demonstrated by additional experiments with Ringer solution. C. S. SHAPIRO (Chem. Abstr.).

Olfactory Reactions in the Brain of the Hedgehog. Adrian, E. D. [*J. Physiol.*, **100**, 459–73 (1942).]

The oscillograph demonstrates a characteristic periodic activity under nembutal anaesthesia in the olfactory bulb and pyriform area. Normal breathing produces a series of large regular waves in the pyriform area at each inspiration. They have no relation to the respiratory movements, their frequency (15–45 per second) being determined by the velocity of the air. Plugging the nose abolishes them. If a strong odor (e.g., cloves) is added to the air, the resting rhythm is replaced by small irregular waves, about 50 per second. With leads from the mitral cell layer of the olfactory bulb a discharge is heard at each inspiration. An odor increases the discharge. These results apparently demonstrate that the olfactory organ is stimulated both mechanically by the air current and chemically by odors in it. The air current produces a uniform excitation resulting in synchronous waves, whereas chemical stimulation is unevenly distributed, the large waves breaking up because of the differential sensitivity of the neurones. Different chemical stimuli apparently produce characteristic distributions of excitation, and thus a familiar smell is recognized by the specific pattern which it arouses in the brain. The olfactory discharge in mammals resembles that previously found in fishes. M. E. MORSE (Psychol. Abstr.).

The Antagonistic Effects of Posterior Pituitary and Corticoadrenal Hormones in the Epileptic Subject. McQuarrie, Irvine, Anderson, J. A., and Ziegler, M. R. [*J. Clin. Endocrinol.*, **2**, 406–10 (1942); *cf. C.A.*, **32**, 7554[8]; **36**, 1657[8].]

The effect of desoxycorticosterone acetate on the water and electrolyte exchanges and on the occurrence of *grand mal* seizures was determined in two severely epileptic patients. It effectively antagonized not only the electrolyte responses, but also the seizure-provoking effect of pitressin. It also decreased the tendency to spontaneous occurrence of seizures. The probable mechanism of this action is discussed. FELIX SAUNDERS (Chem. Abstr.).

Formation of Acetylcholine in the Brain of Pigeons during B_1 Avitaminosis. Karyagina, M. K., and Karlina, M. I. [*J. Physiol. U.S.S.R.*, **29**, 576–81 (*in English*, 581) (1940).]

Experiments were made in an atmosphere of O at 37°. Acetylcholine was determined by stimulation of the dorsal leech muscle (Minz, *C.A.*, **27**, 776). The accuracy of this method is only 10–12 per cent., but because only minute amounts are present it is to be preferred to chemical procedures. In B_1 avitaminosis the brain contained 1·4 times the normal quantity of free acetylcholine, and approximately the normal quantity of combined acetylcholine. Glucose and pyruvic acid added to normal brain tissue produced equal increases in total acetylcholine. In avitaminosis 25 per cent. of cases showed the same rate of increase; the rest showed little or no change. Glucose and pyruvic acid decrease the combined acetylcholine in avitaminized brains, and do not affect free acetylcholine. These experiments *in vitro* suggest that *in vivo* the acetylcholine synthesis must take place with the aid of glucose and pyruvic acid, and confirm the possibility that the synthesis goes through the stage of combined acetylcholine. The decreased or arrested synthesis in B_1 avitaminosis indicates a close relation between acetylcholine formation and the B_1 activity in the body. C. S. SHAPIRO (Chem. Abstr.).

The Lactoflavin Content and Tissue Respiration of the Brain. Leemann, H. and Pichler, E. [*Klin. Wochschr.*, **20**, 36–40 (1941); *cf. C.A.*, **32**, 4221[6].]

Since it is assumed that the tissue respiration remaining after poisoning with HCN or CO (rest respiration) (I) is rendered possible chiefly through the yellow respiration enzyme, a parallelism between the lactoflavin (II) content and (I) is to be expected in the various organs. The (II) content was established by the Emmerie method (*C.A.*, **33**, 3834[3]) (grinding with quartz sand, 24 hours extraction with 75 per cent. MeOH, filtration, oxidation of the filtrate with 4 per cent. $KMnO_4$ in AcOH solution, destruction of the excess permanganate with 3 per cent. H peroxide, filtration, colorimetry with the Pulfrich step photometer) in portions of human brains which had been removed 10–17 hours after death. The free (II) was determined in the dialyzate after dialysis of the ground organ for 24 hours against distilled water. The (II) content, in γ/g., in the various portions of the brain was as follows: stratum 3·8–4·75, nucleus caudatus 2·5–3·75, nucleus ruber + substantia nigra 3·85, nucleus dentatus cerebelli 2·8–3·5, globus pallidus 3·4–4·6, thalamus 3·4–3·48, medulla oblongata 1·7–3·35, midbrain 3·0–3·1, cerebral cortex 2·4–2·8, cerebral medulla 1·47–1·90, and cerebellar medulla 1·7. For the first 24 hours the time of removal had no appreciable effect on the analytical results. The free (II) in the cortex and nucleus caudatus amounted to 16·7 and 20 per cent. respectively of the total (II). (I) was determined by the Warburg method (*C.A.*, **19**, 1720) in brain sections of freshly killed guinea-pigs not later than 10–15 minutes after death; the suspension fluid consisted of NaCl 0·9, glucose 0·2 per cent., and 0·01 M Sørensen phosphate buffer of pH 7·6. Poisoning was produced by the addition of 0·3 c.c. of 0·1 N KCN to 2 c.c. suspension fluid. The following values were found for the respiration without and with the addition of KCN, in cu.mm. O_2/100 mgm. moist weight in 60 minutes, and for the ratio of the respiration with the addition of KCN to that without the addition of KCN, in per cent.: striopallidum 123, 15·3, 12·9; thalamus, 120, 12·5, 10·4; cerebral

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cortex, 97, 10·3, 10·5; medulla oblongata, 104, 9·0, 8·6; midbrain, 101·5, 7·7, 7·5; and cerebral medulla 92, 6·8, 7·3 respectively. With the exception of the relation of the medulla oblongata to the cerebral cortex, the order of (I) is the same as that of the (II) content. Determinations of the (II) content of the guinea-pig brain showed, however, that in contrast to the human brain the cortex was richer in (II) than the brain stalk. The (II) content and (I), therefore, parallel each other. WALTER WILBRANDT, RUTH BERGGREN (Chem Abstr.).

The Biological Properties of the Products of Metabolism of the Central Nervous System of Verbetrates (1). Sessunin, P. A. [*Bull. biol. méd. exptl. U.R.S.S.*, **5**, 496–9 (1938); *Chem. Zenl.* (1), 3293 (1940).]

The action of varying concentrations of the products of metabolism of the brain and spinal cord of different animals on the frog heart (inotropic or chronotropic effect) was studied. The products of metabolism of the brain showed a marked activity. The type of action (sympathicotropic or vagotropic) depends upon the stage of phylogenetic development of the experimental animal. M. G. MOORE (Chem. Abstr.).

Antagonism between Thyroid and Posterior Pituitary and its Relation to the Autonomic Nervous System. Peczenik, O., Popper, L., and Schmid, G. [*Confinia Neurol.*, **3**, 331–47 (1941).]

In normal or thyroidectomized guinea-pigs thyroxine (1) prevented or lessened the effect of procaine (II) in lowering body temperature. When extracts of the posterior pituitary (p.p.) were given along with (I), (II) exerted its usual temperature-depressing effect. Pitressin (III) gave a larger effect than the crude posterior pituitary extract and oxytocin was inactive. In guinea-pigs in which the thyroid has been stimulated by keeping the animals at 0–3° or by administration of the thyrotropic anterior pituitary hormone, posterior pituitary extracts or (III) intensified the effect of (II) in lowering body temperature. It is concluded that (III) does not diminish the activity of the thyroid but that it inhibits the action of the secreted thyroid principle. Atropine counteracted the antagonistic effect of (III) on (I), but adrenaline intensified it. The inhibiting effect of (III) on (I) is related to its parasympathetic action in counteracting the increase in sympathetic tone, produced by (I). The use of (III) in therapy of hyperthyroidism is discussed. WARREN M. SPERRY (Chem. Abstr.).

Convulsive Reactivity in Hypercholesteremia. Spiegel, E. A., and Wycis, H. [*Confinia Neurol.*, **3**, 262–5 (1940).]

Hypercholesteremia, produced in rabbits by intraperitoneal injection of cholesterol (I) emulsions in olive oil, by feeding (I), or by intravenous injections of aqueous emulsions of (I), had no effect on the convulsive reactivity of the brain as determined by electrical stimulation. WARREN M. SPERRY (Chem. Abstr.).

Free and Combined Acetylcholine in Intestinal Tract. Bacq, Z. M., and Goffart, M. [*Schweiz. med. Wochschr.*, **71**, 310–14 (1941).]

The highest concentration of acetylcholine (2.16 γ per gm.) in the intestinal tract of dogs is found in the upper jejunum; lowest concentrations are found in the esophagus (0·27γ) and in the colon (0·66γ). Partial or complete denervation of the intestines raises the content. Sympathetic denervation alone has little effect. The mucosa always contains less acetylcholine than the muscularis. There is agreement between the amount of tissue acetylcholine and that in eserinized venous blood from intact or denervated intestinal segments. The presence of aneurine and its esters in trichloroacetic acid tissue extracts (Chang and Gaddum, *C.A.*, **28**, 519[8]) does not invalidate the assay of acetylcholine. The potency of acetylaneurine on rat gut is like that of choline; the eserinized frog abdominal rectus muscle is insensitive to aneurine and acetylaneurine in concentration of 1 in 10^{-4}; the tissue extracts do not contain sufficient concentration of vitamin B_1 to affect the acetylcholine-effect on muscle; there is no parallelism between the tissue concentration of vitamin B_1 and that of acetylcholine.

B. C. P. A. (Chem. Abstr.).

Relationship between Intercellular Electric Fields and Brain Function. Gerard, R. W. [*Schweiz. med. Wochschr.*, **71**, 397–8 (1941).]

A capillary electrode was placed upon the uninjured ventricular surface in the frog. No injury potential existed between the ventricular electrode (V) and an electrode placed upon the pial surface (P). A regular PV potential of 2–3 mv. existed (sometimes 10 mv. or more). The waves, manifest after the isolated brain was soaked in 0·5 per cent. solution of caffeine for 2–3 minutes, were simpler in form and of greater magnitude if led from PV electrodes instead of two surface electrodes. The potential sign of the caffeine wave became sharply inverted as a micro-electrode was progressively inserted into the pallium. Polarizing currents of 0·01–0·02 ma. with P positive to V initiated caffeine waves in a preparation which had become inactive. The sign of the caffeine wave followed the wave of the PV potential and became reversed with it. MAURICE M. RATH (Chem. Abstr.).

The Cholinesterase Activity of the Serum and the Cerebral Substance of Dogs with and Without a Predisposition for Reflex Epilepsy after Stimulation. Longo, Vito, and Colaciuri, Vittorio. [*Riv. patol. sper.*, **24**, 113–28 (1940); *Chem. Zentr.* (11), 1606 (1940).]

The predisposition to the appearance of epileptic spasm after stimulation by the method of

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Amantea was determined for the group of dogs used. After the appearance of the spasm the cholinesterase content of the blood and that of the urine were found to be reduced in the case of the predisposed animals, while no such reduction in cholinesterase value was observed in the non-predisposed animals. The cholinesterase activity showed a pre-critical increase in the blood and in the nervous tissue of the predisposed animals. The mechanism of the decomposition of acetylcholine is regarded as an important factor in the development of a predisposition to epilepsy. M. G. Moore (Chem. Abstr.).

Study of the Function of the Hypothalamus. Benetato, Grégoire, and Munteanu, N. [*Arch. ges. Physiol.* (*Pflüger's*), **245**, 170–88 (1941); *cf. C.A.*, **36**, 8085.]

Introduction of acetylcholine (I) into the infundibular center produces results similar to electric stimulation of the hypothalamus (II). As little as 0·007γ of (I) produces a detectable fall in blood pressure, which suggests that the function of the blood-regulating center is conditioned by (I) arising from normal physiological processes. Atropine annuls the effect of (I) on blood pressure. The function of (II) involves a cholinergic mechanism.

H. L. Mason (Chem. Abstr.).

Acetylcholine in Sensory Nerves. Brecht, Karl, and Corsten, Martin. [*Arch. ges. Physiol.* (*Pflüger's*), **245**, 160–9 (1941.)]

Determinations of acetylcholine (I) in eserine-Ringer solution extracts of posterior nerve roots of rabbits and cattle and of the optic nerve of cattle showed, respectively, 0·00723, 0·00398 and 0·0315γ. Faradic stimulation of these nerves liberated (I) from the cut surface immersed in eserine-Ringer solution. No detectable amount of (I) diffused from the cut surface of unstimulated nerves. H. L. Mason (Chem. Abstr.).

The Nitrogen Balance in Patients Suffering from Melancholia. Schou, H. I., and Trolle, C. [*Acta Psychiat. Neurol.*, **16**, 243–60 (1941).]

In 14 out of 16 patients with melancholia, a N retention of 0·5 to 1·5 gm./24 hours was found. In general, N equilibrium was re-established with recovery.

M. L. C. Bernheim (Chem. Abstr.).

Prolan and Folliculin Content of the Urine of Schizophrenic Women having Tactile Hallucinations Localized in the Region of the Genitals. Nilsson, Per. [*Upsala Läkareförens. Förh.*, **44**, 495–504 (1939); *Chem. Zentr.* (**11**), 1455 (1940).]

Prolan and folliculin were determined in the urine of nine women having sexual hallucinations caused by schizophrenia. The probability that this condition was caused by hormone disturbances could not be confirmed. M. H. (Chem. Abstr.).

The Antigenic Relationship of Alcohol-Soluble Substances of Corpus Luteum to those of Testis and Brain. Lewis, Julian H. [*Am. J. Path.*, **17**, 725–30 (1941).]

The alcohol extract of beef corpus luteum gives complement-fixation reactions with antiserums for beef corpus luteum, testis and brain. If the corpora lutea have been removed from beef ovaries, then alcohol extracts of the latter do not react with the above antiserums. The antiserum for beef corpus luteum will react with extracts of beef brain and testis but not with those of liver, kidney, heart, lung or spleen. An antihuman brain serum reacts with an alcohol extract of corpus luteum, and an antibeef corpus luteum serum reacts with an alcohol extract of sheep brain. The cross reactions between the alcohol extracts of brain, testis and corpus luteum are apparently not accounted for by the cholesterol present in the extracts.

F. B. Seibert (Chem. Abstr.).

Pyruvic Acid Studies in the Peripheral Neuropathy of Alcohol Addicts. Wortis, Herman, Bueding, Ernest, and Jolliffe, Norman. [*New Engl. J. Med.*, **226**, 376–9 (1942); *cf. C.A.*, **35**, 7481⁶.]

The blood pyruvate content was increased over the normal level in 45 of 48 cases of acute peripheral neuropathy. No hyperpyruvemia was observed in patients with "chronic" peripheral neuropathy or with chronic alcoholism unassociated with nutritional disturbances. After ingestion of glucose, the blood-pyruvate curves in patients with acute neuropathy tended to be abnormally elevated and prolonged, reaching a maximum at the end of 2–4 hours, whereas normally the maximum concentration is reached at the end of the first hour. Acute peripheral neuropathy in the alcohol addict appears to be associated with a deficiency in thiamine, although deficiencies in other nutritive essentials may be involved. The blood pyruvic acid concentration was reduced by thiamine therapy. E. R. Main (Chem. Abstr.).

2. Pharmacology and Treatment.

Effect of Adrenaline, Acetylcholine and Nervous Stimulation on Purine-containing Compounds in Cardiac Muscle. Makarevich-Hal'perina, L. M. [*Biochem. J.* (*Ukraine*), **17**, 115–26 (1941); *cf. C.A.*, **34**, 8013⁸.]

The proportion of phosphorylated nucleotides in heart muscle is decreased by intravenous injection of adrenaline, but increased by acetylcholine and vagus stimulation. This stimulation

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also increases the content of total and free purines. Adrenaline injection also increases the content of free inorganic PO_4 ions, of non-phosphorylated nucleotides, and of total and free purines. The content of total and free purines is not affected by acetylcholine injection, but that of non-phosphorylated nucleotides is decreased. B. C. P. A. (Chem. Abstr.).

Effect of Tri-o-tolyl Phosphate Poisoning upon Nerve-muscle Chronaxie. **Walthard, K. M.** [*Schweiz. med. Wochschr.*, **71**, 392–4 (1941).]

Faradic stimulation of nerves in late injuries following tri-o-tolyl phosphate poisoning in patients may give normal results when study of the nerve-muscle chronaxie shows pathological states. Polyneuritis and independent muscle changes are the causes of the alterations. Upon microscopical examination, the muscle shows partial primary atrophy.

MAURICE M. RATH (Chem. Abstr.).

Effect of Caffeine on Parasympathetic Synapses. **Fredericq, H.** [*Schweiz. med. Wochschr.*, **71**, 368 (1941).]

The effects of stimulating the peripheral end of the vagus nerve upon the tortoise heart are enhanced by 0·5 mgm. doses of caffeine. The latter acts by sensitizing cardiac muscle to acetylcholine. In large doses of 5 mgm., however, caffeine blocks transmission of impulses in the intracardiac vagal ganglia. In all doses, caffeine antagonizes the effects of postganglionic and preganglionic stimulation on the cat nictitating membrane.

MAURICE M. RATH (Chem. Abstr.).

Properties of Acetylcholine Succinate. **Frommel, E., and Bischler, A.** [*Schweiz. med. Wochschr.*, **71**, 372–3 (1941).]

Injections, by the intramuscular, intravenous or subcutaneous routes, of acetylcholine succinate had the same action on the systemic or retinal blood pressure of anesthetized or non-anesthetized rabbits as injections of equimol. concentrations of acetylcholine HCl. The onset of its hypotensive action was not delayed and its action was not prolonged. The salt is lipoid-soluble, is readily soluble in water or alcohol and is very unstable.

MAURICE M. RATH (Chem. Abstr.).

Action of Various Substances on the Autonomic Nervous System. **Stern, L.** [*Schweiz. med. Wochschr.*, **71**, 367–8 (1941).]

Several mgm. of K salts and small doses of acetylcholine caused sympathetic stimulation, as revealed by increased arterial blood pressure, when injected intra-arterially in a number of species of animals. When injected intravenously, K salts produced parasympathetic effects. Ca injected systemically produced sympathetic actions; when injected intra-arterially, parasympathetic effects. Similar results were noted after injection of thyroxine and intraventricular grafts of thyroid gland tissue. MAURICE M. RATH (Chem. Abstr.).

Neuromuscular Junction. XXV: Eserine-like Actions of Aliphatic Alcohols and Ketones. **Feng, T. P., and Li, T. H.** [*Chinese J. Physiol.*, **16**, 317–40 (1941); *cf. C.A.*, **35**, 6668⁹.]

The substances were applied to cat soleus or inferior oblique *in situ* by irrigation and to toad nerve-sartorius preparation by irrigation or as vapour. MeOH and EtOH and Me_2CO intensified Wedensky inhibition, and produced a prolonged contracture (prevented by excess of K or Ca) following indirect, but not direct, stimulation, MeOH being effective after a single shock. They increased the sensitivity to acetylcholine of the sartorius and soleus, augmented post-tetanic facilitation of twitches in the latter, caused prolonged negativity following a single volley in the sartorius and decurarized it by increasing its end-plate potential. The alcohol caused spontaneous twitching of the soleus, and potentiation of twitches accompanied by repeated discharge of the motor nerve endings in all three muscles, while Me_2CO produced these effects in the soleus only. Higher alcohols were less effective.

B. C. P. A. (Chem. Abstr.).

Changes of End-plate Potential during and after Prolonged Stimulation. **Feng, T. P.** [*Ibid.*, 341–72.]

Oscillograph records were taken of the end-plate potential of indirectly stimulated curarized toad nerve-sartorius preparations, with or without eserine, Mg or Ca. The potential declines during rapid stimulation, especially with Ca; at some stage it fails to respond to every other stimulus, especially with eserine or Mg. The potential during low-frequency stimulation, interposed during or after high-frequency stimulation, is greater than that during high-frequency stimulation and may be greater than that during previous low-frequency stimulation, especially with Mg; with Ca, it is at first decreased. The increase of the potential to single shocks following repeated or single volleys lasts longer at lower temperature and is not affected by eserine or Ca; with Mg it rises rapidly to a high maximum. The potential is decreased by direct stimulation.

B. C. P. A. (Chem. Abstr.).

Insulin Hypoglycaemia. **Lawrence, R. D.** [*Lancet*, **241**, 602 (1941).]

When diabetic patients are first given insulin hypoglycaemic reactions they show marked autonomic disturbances e.g., faintness, sweating tremors and hunger pains, before signs of

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affection of the central nervous system appear, e.g., mental confusion, symptoms like alcohol intoxication, convulsions and coma. After a few years of insulin usage the premonitory autonomic symptoms fail to appear and central nervous symptoms appear without warning.
B. C. P. A. (Chem. Abstr.).

Insulin, Cholesterol, Emotions and Psychosis. Stenberg, Sven. [*Acta Psychiat. Neurol.*, **16**, 289–324 (1941).]

In 21 cases of strong emotional disturbance the cholesterol level in the blood was high. When insulin treatment was successful the cholesterol values decreased. In six cases of schizophrenia, without emotional disturbance insulin treatment had no effect, and the blood cholesterol was slightly higher after treatment than before. M. L. C. BERNHEIM (Chem. Abstr.).

The Influence of Large Doses of Insulin on the Respiration of Brain Tissue. Komisarenko, V. P., and Maevskaya, I. P. [*J. méd. Ukraine*, **10**, 1145–52 (*Russian and German summaries*) (1940); *cf. C.A.*, **35**, 4850.[2]]

These experiments were performed to determine whether the convulsions and coma which appear after large doses of insulin are caused by a diminished consumption of carbohydrate or by a direct toxic action of the insulin. The sugar content of the blood and the respiration of the cerebral tissue were studied in rabbits which had received large doses of insulin (10 units per kgm.), and had been decapitated immediately upon the appearance of coma or convulsions. The respiration of the cerebral tissue was studied by the Thunberg method (*C.A.*, **33**, 88[9]) in rabbits which had been decapitated 2½ hours after the administration of insulin; of the animals studied 20 were decapitated upon the appearance of convulsions and 20 in the absence of convulsions, while 20 rabbits served as controls. In 22 rabbits (11 controls and 11 experimental animals) the capacity of the brain tissue to take up O was studied by the eudiometric method of Batelli and Stern. The brain tissues of insulinized rabbits decapitated during convulsions (2½ hours after the administration of insulin) showed a prolonged reduction of methylene blue compared with the tissues of the control animals, while the brain tissues of insulinized rabbits decapitated in the absence of convulsions (2½ hours after the administration of insulin) reduced methylene blue the same as the brain tissue of normal rabbits. The amount of O taken up by the cerebral tissue of insulinized rabbits was significantly smaller than that of normal rabbits. In these experiments the intensity of the cerebral tissue respiration in the insulinized rabbits was not found to be directly dependent on the extent of reduction of the sugar content of the blood. The diminution in the intensity of the cerebral tissue respiration under the influence of large doses of insulin is probably not caused so much by the reduction of the sugar supply and uptake in the cerebral tissue as by the toxic action of the insulin on the respiration enzymes of the brain. RUTH BERGGREN (Chem. Abstr.).

The Effect of Large Doses of Insulin on the Glycolytic Activity of Cerebral Tissue. Komisarenko, V. P., and Marchuk, R. Ya. [*J. méd. Ukraine*, **10**, 1135–43 (*Russian and German summaries*) (1940); *cf. C.A.*, **35**, 4850[2].]

The experimental animals (18 dogs) were decapitated upon the appearance of insulin convulsions and coma. Glycogen reducing substances (since the formation of lactic acid in the tissues takes place chiefly at the expense of the reducing substances) and preformed lactic acid were determined in the brain, muscle and liver tissues. The increase in lactic acid was determined after two hours' autolysis at 38°. Similar experiments were performed on the control dogs (without insulin). The effect of insulin, which had been administered to dogs in large doses (10 units per kgm. body weight), on the glycolytic activity of the cerebral tissue, skeletal muscle and liver differed. The glycolytic activity of the cerebral tissue (after two hours' incubation) was significantly higher in the insulinized dogs and that of the muscle tissue was diminished compared with the control dogs, while the increase in lactic acid in the liver tissue of the experimental dogs did not differ markedly from that of the control animals. The amounts of preformed lactic acid in the brain tissue of insulinized dogs was significantly smaller than in the control animals. The decrease in the amount of preformed lactic acid in the brain tissue of insulinized dogs with simultaneous increase in its uptake by the brain tissue and the absence of a noticeable increase in the glycogen content of the brain indicate that large amounts of lactic acid were oxidized. The content of preformed lactic acid in the muscle tissue of insulinized dogs was greater than that of the control dogs, while in the liver tissue the increase in preformed lactic acid was insignificant compared with the control experiments. The increase of lactic acid in the brain tissue in insulinized animals is probably caused by the greater intensity of enzymic processes in the brain tissue. RUTH BERGGREN (Chem. Abstr.).

Schizophrenic-brain Metabolism in the Course of Insulin-shock Treatment, with Special Reference to Blood Carbon Dioxide and the Tendency to Convulsions. Wortis, Joseph, and Goldfarb, Walter. [*N.Y. State J. Med.*, **42**, 1053–9 (1942); *cf. C.A.*, **31**, 8703[2]; **33**, 5512[9]; **35**, 3717[2];4838[3].]

The metabolism of the schizophrenic brain was studied before and during insulin hypoglycemic coma as well as before and after a series of treatments. The arteriovenous O difference of the schizophrenic brain did not differ from the normal; no change in the average arteriovenous O difference was observed in a group of schizophrenic patients after a course of 30 or

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more shock treatments. During insulin coma the arteriovenous O differences were regularly found to be markedly reduced. The arterial CO_2 content was elevated within one hour after the insulin injection, and returned to normal within half an hour after glucose administration. In cases which developed seizures, the arterial CO_2 was found to rise sharply preceding the onset of convulsions. During or after the post-convulsive period of hyperpnea very low CO_2 values were found. These results indicate that there is a depression of the respiratory center during insulin hypoglycemia which results in a decreased sensitivity to the normal stimulus of blood CO_2. In those patients who showed abnormally low blood CO_2 values preceding treatment, the tendency of the treatment was to restore normal values.

RUTH BERGGREN (Chem. Abstr.).

Mental Symptoms in Bromide Intoxication. Kitching, E. Howard. [*Brit. Med. J.*, **1**, 754–7 (1942).]

Mental symptoms are described in 9 cases of bromide intoxication after prolonged treatment with large doses of bromides. Blood bromide values were over 200 mgm./100 c.c. as compared to a normal of 2·5. J. B. BROWN (Chem. Abstr.).

Appearance of a Barbiturate in Human Milk. Mayo, C. W., and Schlicke, C. P. [*Proc. Staff Meetings Mayo Clinic*, **17**, 87–8 (1942).)]

Barbiturate appeared in the milk, as well as in the blood and urine, after injection of pentothal-Na into the veins of a lactating woman. RUTH BERGGREN (Chem, Abstr.).

Studies on Barbiturates, Especially their Cyclic Disappearance from and Reappearance in the Blood Following Intravenous Injection. Anderson, B. M., and Essex, H. E. [*Proc. Staff Meetings Mayo Clinic*, **17**, 337–9 (1942).]

These experiments apparently confirm Delmonico's observation (Theses, University of Minn., 1940) on the cyclic variation of concentration of barbiturate in the blood of the intact dog, and reveal that such a variation is produced by the isolated heart and lungs, legs and kidneys (2 heart-lung preparations, 2 heart-lung hind leg preparations and 2 heart-lung kidney preparations were used). The fact that these results were obtained repeatedly in several experimental setups and with two different analytical methods eliminates the possibility that this cyclic disappearance and reappearance in the blood of barbiturates injected intravenously is purely one of chance. No satisfactory explanation of this phenomenon can be offered.

RUTH BERGGREN (Chem. Abstr.).

Influence of the Cation on the Hypnotic Power of Mineral Salts of Barbituric Acids. Salts of Cyclopentenylallylbarbituric Acid. Rolland, Pierre, and Vieillefosse, Roger. [*Bull. soc. chim. biol.*, **22**, 512–19 (1940).]

The solubility in water of the salts of cyclopentenylallylbarbituric acid decreased in the order Na, Li, K, Cs, Rb, Mg, Ca. The effects on fish and rats were determined. No significant differences in action were found except that the action of the Mg salt was shorter than that of the others. L. E. GILSON (Chem. Abstr.).

Human Blacktongue Treated with Nicotinic Acid. Wilkinson, P. B. [*Caduceus*, **19**, 100–2 (1940); *Trop. Diseases Bull.*, **88**, 721 (1941).]

In an otherwise healthy woman, who had been on a well-balanced diet and showed none of the signs of the pre-pellagrous state, there was hypertrophy of the filiform papillae of the tongue with grey or black pigmentation. The tongue was almost clean within 72 hours after the oral administration of 50 mgm. nicotinic acid morning and night. The etiology of the condition is not clear. So far as is known, there is no connection with canine blacktongue.

RUTH BERGGREN (Chem. Abstr.).

Influence of Experimental Fever upon the Constituents of Cerebrospinal Fluid. (III) Urea. IV. Amino Acids. (V) Total Creatinine. Nisizima, Itiro. [*Nagoya Igakkai Zassi (J. Nagoya Med. Assoc.)*, **51**, 237–56 (1940); *Japan. J. Med. Sci.* (II), *Biochem.*, **4**, No. 4, *Abstracts (in English)* (*III*) (1941).]

In fever caused by typhoid vaccine and tetrahydro-β-naphthylamine in the rabbit and also by keeping the animal in an incubator, the urea, amino acid, creatine and creatinine contents of cerebrospinal fluid were increased. C. L. B. (Chem. Abstr.).

Effects of Benzedrine on Respiration and Oxygen Consumption after Morphine in Men and Rats. Abreu, Benedict E., and Handley, Carroll A. [*Univ. Calif. Pub. Pharmacol.*, **2**, 99–104 (1942).]

In man, oral administration of morphine sulfate, in dose of 0·3 mgm. per kgm. of body weight, did not significantly depress O consumption or respiration; in such morphinized persons, the same dose of benzedrine sulfate did not increase O consumption or stimulate respiration. In albino rats, which had received morphine sulfate in an intraperitoneal dose of 20 mgm. per kgm., benzedrine sulfate, in an intraperitoneal dose of 10 mgm. per kgm., significantly increased the O consumption. JOSEPH S. HEPBURN (Chem. Abstr.).

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Immediate Metabolic Effect of Benzedrine Sulfate in Man. Emerson, George A., and Abreu, B. E. [*West Virginia Med. J.*, **37**, 74–7 (1941).]

The oral administration of 20 mgm. benzedrine sulfate to each of 15 young men and 5 young women caused a mean maximum increase in O_2 consumption of 15·7 = 3·1 per cent. of the basal level. Two individuals showed increases of 42 and 54 per cent. respectively and one a decrease of 13 per cent. of the basal level. Correlation of magnitude of metabolic effect with basal metabolic rate shows a significant inverse relationship. RUTH BERGGREN (Chem. Abstr.).

Changes in the Composition of the Gases of the Blood under the Influence of Narcotics (Diethyl ether). Zlastion, M. I. [*Méd. exptl.* (*Ukraine*), 1939, *No.* 1, 36–42; *Chem. Zentr.* (**11**), 1612 (1940).]

In dogs ether narcosis caused a reduction in the arterial O content and saturation, i.e., an arterial anoxemia developed. In most cases the same changes were observed in the venous blood. The anoxemia had a deleterious effect upon the respiratory center. The changes in the respiratory activity during narcosis resulted in a reduction in the CO_2 content of the blood. M. G. MOORE (Chem. Abstr.).

Studies on the Action of Narcotics and the Tolerance to Narcotics in Childhood. (III) The Content of Adaline and Noctal in the Rabbit Brain after Narcotic Doses. Grüninger, U., and Scheurenberg, G. [*Z. ges. exptl. Med.*, **107**, 529–31 (1940); *Chem. Zentr.* (**11**), 2050–1 (1940); *cf. C. A.*, **82**, 5503[8].]

A dose of 700 mgm. of Adaline was administered *per os* to a rabbit 2 kgm. in weight. Twenty minutes later the brain (fresh weight 7·855 gm., dry weight 1·755 gm.) was found to contain only 0·306 mgm. (3·8 mgm. per cent. of the fresh weight) of Adaline. The larger portion of the drug was decomposed in the stomach. Moreover, the blood and liver contained only slight amounts of undecomposed Adaline. The administration of 300 mgm. of Noctal to a rabbit of 1·71 kgm. weight produced a strong narcotic effect. However, less than 1 mgm. of the preparation was found in the brain. A portion of this was an ether-soluble decomposition product. The Noctal was less rapidly decomposed in the stomach than Adaline. After the administration of 0·1 gm. Noctal per kgm. of body weight, which produced no symptoms, no undecomposed drug was found in the brain. A large portion was decomposed in the stomach. Adaline and Noctal were determined by the refined Br method of Leipert and Watzlawek (*C.A.*, **28**, 6749[6]). M. G. MOORE (Chem. Abstr.).

Fluctuation of Narcotic and Hyperglucemic Effect of Several Narcotics on Rabbits of Different Age. Asakawa, Hisasi. [*Mitt. med. Ges. Okayama*, **51**, 2175–6 (1939); *Chem. Zentr.* (1), 77 (1941).]

The narcotic effect of equal amounts (per kgm. body weight) of morphine, chloral hydrate, veronal, luminal and urethan is smaller and briefer in young rabbits than in adult animals. Veronal and luminal (120 and 80 mgm. per kg., respectively) have practically no effect on grown rabbits, but in young ones they produce hyperglucemia. Urethan (1–1·5 gm. per kgm.) produces hyperglucemia in both young and grown animals. Chloral hydrate (0·2–0·5 gm. per kgm.) causes hyperglucemia in grown rabbits, hypoglucemia in young animals. Morphine (5–20 gm. per kgm.) produces hyperglucemia in old as well as young rabbits. M. HOSEH (Chem. Abstr.).

Absorption of Narcotics by the Skin. Vorozhtsova, E. D. [*Akusherstvo i Ginecol.*, *No.* 1, 93–5 (1939).]

A bandage soaked in a 50 per cent. alcohol solution of chloral hydrate (equivalent to 2 gm. per kgm. body weight) placed on a shaved portion of rabbit skin produced a long (18–24 hrs.) sleep frequently leading to death. The state of narcosis came on only after 4–7 hours. Chloroform applied to the skin in the same manner (one or two 10 gm. doses) penetrated the skin in 2–4 hours and induced sleep of 30–90 minutes in 41·6 per cent. of animals. Aqueous solutions of evipan-Na and alcohol solutions of barbital and phenobarbital in 1·5–2·0 gm. doses were totally ineffective. C. S. SHAPIRO (Chem. Abstr.).

Awakening Action of Various Analeptics in Narcosis Induced by Alcohol or Chloralose. Hess, J. [*Arch. exptl. Path. Pharmakol.*, **197**, 204–9 (1942).]

In rats narcotized with EtOH moderate doses of metrazole, coramine, pervitin and cycliton had an awakening action, while large doses of coramine or cycliton prolonged the narcosis. In narcosis produced by chloralose, metrazole and pervitin prolonged the narcosis and coramine and cycliton had a marked toxic action. L. E. GILSON (Chem. Abstr.).

Variation in the Mineral Constituents of the Plasma during the Antagonistic Action of Metrazole and Coramine (on Chloralose Narcosis). Cardini, C. E., and Serantes, M. E. [*Anales farm. bioquim.* (*Buenos Aires*), **13**, 9–23 (1942).]

Chloralose anesthesia causes a decrease in the K of the blood plasma. The injection of metrazole into a chloralosed dog causes convulsions and a transient awakening accompanied by a transient but marked rise in plasma K. Injection of a large dose of coramine causes convulsions

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and a transient rise in plasma K without awakening the animal; smaller doses may produce transient convulsions without any rise in K. The other mineral constituents of the plasma show no important change after injection of either drug. L. E. GILSON (Chem. Abstr.).

The Effect of Analeptics on the Circulation. (II) Changes in the Time of Circulation of the Blood and in the Gases of Arterial and Venous Blood after the Administration of Various Analeptics. Bansi, H. W., and Kalinke, M. [*Z. ges. exptl. Med.*, **103**, 301–19 (1938); *Chem. Zentr.* (**11**), 660 (1940); *cf. C.A.*, **32**, 1789⁷.]

Centrally acting analeptics (metrazole, coramine, neospiran) and the adrenaline substances (ephedrine, suprifen, sympathol, icoral) produced no increase in the O content of the arterial blood in inflammatory disorders of the lung tissue in which there was a retardation of the passage of O into the alveoli. After injection of analeptics blood CO_2 was diminished as a result of a centrally excited deepening of respiration. In fevers the circulation time was often shortened by analeptics, especially by those of the adrenaline group, and the flow of the peripheral blood was accelerated. The amount of blood circulating peripherally was occasionally reduced by metrazole and icoral. M. G. MOORE (Chem. Abstr.).

The Action of Metrazole. Gutierrez-Noriega, C. [*Rev. soc. biol. Lima*, **1**, *No.* 2 (1939); *Rev. sud-americana endocrinol. immunol. quimioterap.*, **25**, 148 (1942).]

From experiments on mammals, toads and insects it is concluded that the convulsions caused by metrazole are due to an immediate action on the neuron. The theory that the effect is caused by vasoconstriction is rejected. A. E. MEYER (Chem. Abstr.).

Antagonistic Action of Metrazole and Sparteine. Schnittspahn, Ferd. [*Arch. exptl. Path. Pharmakol.*, **197**, 252–8 (1941).]

Metrazole and sparteine are mutual antagonists in their action on respiration and blood pressure. L. E. GILSON (Chem. Abstr.).

Effects of Cocaine and Sympathomimetic Amines on Humoral Transmission of Sympathetic Nerve Actions. Lawrence, W. S., Morton, M. C., and Tainter, M. L. [*J. Pharmacol.*, **75**, 219–25 (1942); *cf. C.A.*, **34**, 6713.]

When cocaine and adrenaline in Locke solution are perfused together through the cat isolated leg the pressor responses are increased and the rate of destruction of adrenaline by the tissues is decreased. When the sympathetic nerves to the leg are first allowed to degenerate and the perfusion is made with diluting defibrinated ox blood, the absolute pressor potency of adrenaline, cobefrine and neosynephrine is increased severalfold although their relative activities, compared to one another, remain unchanged. These amines, ephedrine and tyramine, do not show the above increase in vasoconstrictor potency, and hence must act independently of the sympathetic endings in the blood vessels. The cat nictitating membrane is not suitable for this type of study. It is postulated that ephedrine, tyramine and cocaine partially block the enzyme within the smooth muscle cell which inactivates the adrenaline taken into the cell continuously from the blood stream, or the sympathin derived intermittently from the local sympathetic endings. The resulting local increase in adrenaline or sympathetic nerves makes the muscle cell more permeable to adrenaline, sensitizing the cells to adrenaline, but not to ephedrine and tyramine, which act through a different mechanism. L. E. GILSON (Chem. Abstr.).

Epilepsy following Application of Sulfathiazole near the Brain. Watt, A. C., and Alexander, G. L. [*Lancet* (**1**), 493–5 (1942).]

Five cases of epilepsy following application of sulfathiazole in the proximity of the brain are reported. In experiments on cats and dogs, application of sulfathiazole to the cerebral surface was followed by an epileptic syndrome comparable to that observed clinically. Sulfapyridine, sulfadiazine and sulfanilamide did not have this effect. E. R. MAIN (Chem. Abstr.).

The Effect of Propazone on the Metabolism of Rat Cerebral Cortex in vitro. Fuhrman, Frederick A., and Field, John, 2nd. [*J. Cellular Comp. Physiol.*, **19**, 351–9 (1942); *cf. C.A.*, **36**, 3261⁶.]

Propazone (5, 5-dipropyl-2, 4-oxazolidinedione) inhibits the O consumption of excised cerebral cortex of the albino rat, suspended in Ringer-phosphate-glucose at 37·5°. Inhibition is evoked by propazone concentrations ranging from $9{\cdot}66 \times 10^{-6}$ M to $1{\cdot}21 \times 10^{-1}$ M. Concentrations below $9{\cdot}66 \times 10^{-6}$ M have no effect on brain respiration. No stimulation is observed with graded concentrations ranging down to $4{\cdot}83 \times 10^{-1}$ M. About 15 per cent. of the respiration is propazone-stable and is not affected by concentrations up to $1{\cdot}21 \times 10^{-1}$ M. The action of propazone is selective to some extent. Concentrations which markedly inhibit respiration with glucose and pyruvate as substrate have little effect when the substrate is succinate or p-phenylenediamine. With fall in temperature the maximum percentage inhibition of respiration decreases. At 40°, 16 per cent., and at 15° 60 per cent. of this respiration is propazone-stable. Anaerobic glycolysis is not affected by propazone concentrations as high as $2{\cdot}42 \times 10^{-2}$ M (which produced maximum inhibition of respiration in Ringer-phosphate-glucose solution). Propazone appears to inhibit brain respiration in a manner similar to other central nervous system depressants. However, it is preferable to most such agents for investigation *in vitro* because of its great solubility in water and its neutral reaction. FELIX SAUNDERS (Chem. Abstr.).

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The Pellagra-preventive Factor of Vitamin B. I–XVII. *Pawel, Martinus.* [*Rev. gastro-enterol. São Paulo*, **3**, 85–101, 115–26, 145–60, 183–218 (1940–41); *Trop. Diseases Bull.*, **39**, 574 (1942).]

A highly condensed and amply documented statement of the various aspects of this much debated subject. The pellagra-preventing activity of the pyridine compounds, the biological specificity of the factor, its metabolism, the biochemistry of glucolysis, the possible connection with porphyrin excretion and the effect of S are discussed.

RUTH BERGGREN (Chem. Abstr.).

Serum Therapy in Epidemic Meningitis, and Studies on the Sugar and Cell Content of Spinal Fluid. *Stoffel, Walter.* [*Deut. Arch. klin. Med.*, **186**, 113–24 (1940).]

A sharp decrease in the sugar content of the spinal fluid is an unfavorable sign in epidemic meningitis. An attempt has been made to correlate variations in sugar content with neurological symptoms.

P. Y. JACKSON (Chem. Abstr.).

Clinical and Experimental Studies on the Influence of Vitamin B_1 on Postdiphtheritic Paralysis. *Dieckhoff, J.* [*Monatsschr. Kinderheilk.*, **82**, 53 (1940); *Klin. Wochschr.*, **19**, *Ref. Tl.* 957 (1940).]

In animal experiments vitamin B_1 exerted neither a prophylactic nor a therapeutic effect in postdiphtheritic paralysis. It was also unsuccessful clinically. The slight decrease in the aneurine content of the blood plasma in the 2nd and 3rd weeks in toxic diphtheria has no connection with the postdiphtheritic neuritis. The early intensive serum treatment of acute diphtheria remains the most reliable treatment of postdiphtheritic paralysis.

RUTH BERGGREN (Chem. Abstr.).

The Action of Respiratory Poisons on Frog Spinal Cord. *Lueken, B., Soehring, Kl., and Jebramek, H.* [*Z. Biol.*, **100**, 486–517 (1941).]

The determinations were done on preparations of the entire spinal cord (except for a few 3-segment lengths) kept in Ringer's solution at 3–5°. The action of HCN, H_2S, CO and Et_2O were tested on a simple function of the central nervous system. Although essentially similar, the effect of NaCN (0·04–4 per cent.) varies with the concentration in respect to period before onset and strength of the reaction. At high concentration spasms begin after a few minutes, accompanied by paralytic symptoms which become more prevalent the longer the cyanide is in contact. These reactions are reversible. H_2S (administered both as the gas and liberated by HCl from Na_2S) gives similar effects which are irreversible particularly at paralysis. CO, in pure form or in combination with O, possesses an exclusively paralysing effect which continues in the dark but becomes reversible with exposure to light. Et_2O added to the Ringer's solution in doses of 0·5–10 per cent. results in spasms followed by paralysis for the high percentage, whereas there is no spasmic stage for the low.

N. SCHEINFINKEL, FRANCES KRASNOW (Chem. Abstr.).

The Pharmacological Action of Some So-called Extra Pyramidal Poisons. (II) The Action on the Rabbit Uterus in situ, on Isolated Smooth Muscle and on the Muscles of the Earthworm. *Aoyama, Tutomu.* [*Mitt. med. Ges. Okayama*, **51**, 576–7 (1939); *Chem. Zentr.* (11), 2054–5 (1940); *cf. C.A.*, **34**, 7418⁶.]

Bulbocapnine in small doses had a stimulating effect on the rabbit uterus *in situ* but medium to large doses were inhibitory. The stimulating action was due in part to stimulation of the peripheral para-sympathetic fibers and in part to stimulation of the uterine musculature. The inhibiting effect was the result of stimulation of the sympathetic centers. Harmine and harmaline had a stimulating effect in all concentrations, which was brought about predominantly by the action on the sympathetic centers, less by that on the musculature. Small doses of all three of the preparations mentioned had a stimulating effect on the isolated uterus and the smooth musculature of the rabbit and on the rat uterus. Medium doses usually had a stimulating effect or an initial stimulating effect followed by paralysis, while high concentrations had a paralyzing action. On the surviving small intestine of the rabbit small doses were stimulant, medium doses inhibitory and large doses paralytic. The isolated detrusor of the rabbit bladder was stimulated by small doses and paralyzed by large ones. When medium doses were used harmine and harmaline produced stimulation exclusively, while bulbocapnine produced inhibition either from the beginning or after an initial stimulation. Small doses of bulbocapnine had an inhibitory effect on the isolated small intestine of the rat; medium doses had either an inhibiting or a stimulating effect, while large doses either had a stimulating effect or an inhibiting action following an initial stimulation. Harmine and harmaline in small doses sometimes produced stimulation and sometimes inhibition; in medium doses these preparations either produced inhibition or paralysis following an initial inhibitory effect; in large doses they produced only paralysis. The stimulating action of the three preparations and the inhibitory action of harmine and harmaline on the small intestine of the rabbit and the rat were muscular effects. The inhibiting effect of bulbocapnine on the small intestine of the rat was due to stimulation of the sympathetic nerves; that on the detrusor of the rabbit bladder was due in part to stimulation of the musculature. The muscle of the earthworm was stimulated by small and medium doses of bulbocapnine and paralyzed by large doses. Harmine and harmaline had only a stimulating effect.

M. G. MOORE (Chem. Abstr.).

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Relation of B Vitamins and Dietary Fat to the Lipotropic Action of Choline. Engel, R. W. [*J. Nutrition*, **24**, 175–85 (1942); *cf. C.A.*, **38**, 9375⁸.]

When thiamine, riboflavin, pantothenic acid, pyridoxine, corn oil and choline were fed to rats receiving a purified diet containing 18 per cent. casein for a three-week experimental period, an abnormal accumulation of liver fat resulted. Under these conditions 2 mgm. of choline chloride per rat per day failed to prevent the kidney hemorrhages of choline deficiency. At least 10 mgm. of choline chloride was necessary for this factor to exert its maximum lipotropic action, but normal liver-fat levels were still not being maintained. The addition of 3 mgm. of inositol per rat daily to the diet adequate in choline and containing the above B vitamins reduced the liver fat to the normal level found in rats receiving an adequate stock diet. Prolonged feeding of a diet deficient in pyridoxine or essential fat acids resulted in fatty livers, even though the diet contained adequate choline. Conclusion: Pyridoxine and a source of essential fat acids are necessary in the diet for choline to function properly as a lipotropic agent. Inositol, in addition to choline, is a necessary dietary constituent for the rat receiving purified diets supplemented with the other B-vitamins known to be required by the species.

C. R. Fellers (Chem. Abstr.).

The Influence of the Quality of the Diet on the Action of Acetylcholine and the Synergism between Aneurine (Vitamin B_1) and Acetylcholine. Abderhalden, Rudolf. [*Arch. ges. Physiol. (Pflüger's)*, **245**, 155–9 (1941).]

Rats fed on meat (rabbit) were less sensitive to acetylcholine (I) than rats fed on mixed grains. When fed a vitamin B_1-free diet rats were more resistant to (I). Injection of 1 mgm. of aneurine 0·5–1 hour before the test increased slightly the sensitivity of normally fed rats to (I). H. L. Mason (Chem. Abstr.).

Cure of Paralysis in Rats with Biotin Concentrates and Crystalline Biotin. Nielsen, Edward, and Elvehjem, C. A. [*J. Biol. Chem.*, **144**, 405–9 (1942); *cf. C.A.*, **36**, 522⁷.]

A typical paralysis or spasticity of the hind legs develops in biotin-deficient rats. This paralysis is produced consistently by the inclusion of egg white in a synthetic diet which allows good growth in the absence of egg white. High levels of fat in the diet did not hasten the onset of this spasticity but had a slight protective action. Riboflavin, pyridoxine or the combination of the two vitamins did not correct the paralysis. The leg muscle creatine of paralytic rats is abnormally high, decreasing upon the administration of biotin. The paralysis observed is not due to low creatine levels. The animals showed no gross pathology of the nerves as is the case with riboflavin rats. W. J. Peterson (Chem. Abstr.).

The Physiological Role of Adrenaline, Sympathin and Acetylcholine. Danielopolu, D., and Marcu, I. [*J. physiol. path. gén.*, **37**, 1290–1341 (1939–40); *cf. C.A.*, **34**, 3797⁸. *Research on the Condition of the Blood Vessels in Adrenalectomized Animals.*]

The experiments were carried out on dogs, rarely on cats. The general vascular toxicity is established according to the variations in the blood pressure of the carotid, and the local vascular toxicity in the dog foot is determined according to the variations in the pressure in the peripheral end of the femoral artery. After the operation there is a first phase of hypotension due to the operative shock; then the pressure is partially restored and at the end of several hours there is a second phase of hypotension. The experiments are carried out in this second phase. The action of adrenaline in this phase is less intense, slower and of longer duration than before the operation. The explanation offered is that a factor X (which the authors call complex adrenaline) maintains the excitability of the terminal organ. X seems to be a product of transformation of the medullo-adrenal adrenaline. In fact after injecting an extract of real adrenaline from the animal the same dose of adrenaline produces a more intense effect, more rapid and of shorter duration. The excitation of the lumbar sympathetic system, which has no effect on the blood pressure in the adrenalectomized animal, produces a new vascular reaction after the injection of a suprarenal extract. The action of adrenaline in hypotension which is kept up with an abundance of blood is normal. *Experiments made on adrenalectomized animals:* The results show that adrenaline injected into the animal is not destroyed, as is suggested by the transiency of its action, but is transformed into a complex adrenaline. In the adrenalectomized animal which reacts feebly and slowly to an injection of adrenaline, successive injections of adrenaline produce reactions which are more and more intense and rapid (phenomenon of sensitization to adrenaline). The adrenaline sensitizes the vessels to the action of vaso-constrictors (sympathin). An extract of the animal's adrenals made up in physiological salt solution possesses the same properties of sensitization as adrenaline. The excitation of the sympathetic fibers sensitizes the vessels for the action of adrenaline; adrenaline also sensitizes the vessels to the action of vasodilators (acetylcholine). Acetylcholine in small doses produces a sensitization of the vessels to adrenaline. The authors studied the existence of a product of transformation of acetylcholine (complex acetylcholine) which maintains the excitability of the organs. *The role of adrenaline, sympathin and acetylcholine:* Adrenaline, secreted by the adrenal medulla (efficient adrenaline), is poured into the blood and is changed in the organism into a new product which does not have the excitation or inhibitory properties of the efficient adrenaline (complex adrenaline). This maintains the excitability of the terminal organ of sympathetic and parasympathetic systems, and probably constitutes the stock from which the sympathetics draw the efficient sympathin and

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the chromaffin cells, the efficient adrenaline. The principal role of the adrenal medulla is not to maintain the tone of the organs (a function which appears to be taken care of by the sympathetic and parasympathetic nerves, and consequently by sympathin and efficient acetylcholine), but to maintain in the fluids and organs a permanent concentration of complex adrenaline.

GUIDO RIVA, BENJAMIN PRESCOTT (Chem. Abstr.).

Effect of Alcohols and Related Substances on Sensitivity of Muscles to Acetylcholine. Meng, C. W. [*Chinese J. Physiol.*, **16**, 291–302 (1941).]

Alcohols increase the sensitivity of toad rectus muscle to acetylcholine; aldehydes, ketones and higher alcohols are more, while polyhydric, secondary and tertiary alcohols are less effective. They cause contracture in the same relative concentrations. Their action is unaffected by denervation or eserine; they do not inhibit cholinesterase, but increase the sensitivity of the muscle to nicotine.

B. C. P. A. (Chem. Abstr.).

Routine Treatment of Epilepsy with Snake Venom. Chowhan, J. S. [*Indian Med. Gaz.*, **75**, 382 (1940); *Trop. Diseases Bull.*, **38**, 170 (1941).]

Cobra venom acts as an anticonvulsant; it probably reduces the sensitivity of the higher centers to extraordinary incoming impulses. Russell viper venom appears to alter the mineral and water metabolism and thus influences the epileptic convulsions. Extract of *Rauwolfia serpentina* is given by mouth as a sedative and is used along with the injections of the venom.

RUTH BERGGREN (Chem. Abstr.).

Relation between the Excitability of the Central and Peripheral Motor Neurons of Frogs during Various Pharmacodynamic Effects. Chauchard, Jacqueline. [*J. Physiol. path. gén.*, **37**, 1362–71 (1939–40); *cf. C.A.*, **32**, 7125[8].]

In *Rana temporaria* or *R. esculenta* drugs were applied directly to the exposed optic lobes of the brain, or were injected into the lymph sacs, or if volatile were given by way of the respiratory tract. Morphine, $CHCl_3$, chloral and evipal first decreased, then increased, central and peripheral motor chronaxie. When the central neurons became inexcitable the peripheral chronaxie returned to normal. Pyrethrins, acetylcholine, adrenaline and yohimbine first decreased, then increased, central and peripheral chronaxie. Atropine increased both central and peripheral chronaxie. The isochronism that normally exists between central and peripheral neurons seems to persist during the action of toxic drugs as long as the central neurons remain excitable.

GUIDO RIVA, L. E. GILSON (Chem. Abstr.).

Cure of Experimental Staphylococcal Meningitis. MacNeal, Ward J., Spence, Martha J., and Blevins, Anne. [*Proc. Soc. Exptl. Biol. Med.*, **50**, 176–9 (1942).]

Infected rabbits were saved by combined treatment with bacteriophage and sulfathiazole.

L. E. GILSON (Chem. Abstr.).

Peripheral Neuritis following the Administration of a Glucose-sulfapyridine Compound. Sugar, Samuel J. [*New Engl. J. Med.*, **226**, 1021–2 (1942.)]

Peripheral neuritis developed after the administration of a condensation product, containing 1 molecule glucose and 1 molecule sulfapyridine. A total of 50 gm. glucose-sulfapyridine and 2 gm. sulfapyridine was given in six days. The effects are considered to be due to sulfapyridine alone, since the complex is broken down in the intestinal tract.

E. R. MAIN (Chem. Abstr.).

The Role of the Sympathetic Nervous System in the Cataleptic Action of Tetrahydro-β-naphthylamine. Tonkikh, A. V. [*J. Physiol. U.S.S.R.*, **27**, 41–8 (1939); *Chem. Zentr.*, 1940, **1**, 3815.]

Symptoms of general excitation, increase in body temperature and metabolic rate, and changes in muscle tone were observed in cats after subcutaneous injection of tetrahydro-β-naphthylamine (I). In sympathectomized cats the increases in body temperature, metabolic rate and muscle tone were less pronounced. Experiments on cats subjected to different operations indicated that the action of (I) is both central and peripheral.

M. G. MOORE (Chem. Abstr.).

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Part I.—Original Articles.

A PSYCHOMETRIC STUDY OF SENILITY.

By H. HALSTEAD, B.A.,
Psychologist to Mill Hill and Sutton E.M.S. Hospitals.

(Received May 24, 1943.)

PROBLEM.

THE writer undertook to try out a number of mental tests on a group of senile patients and to submit a tentative battery for a further investigation of senescence.

This article deals with the selection of tests and the results of the full scale on 20 seniles. In all, 38 patients were tested, and the results on the second group, who appeared clinically to be more demented, will be reported later.

Very little work has been done in the measurement of senility (1), so that some preliminary criteria seemed to be necessary. It was decided that about an hour for each patient would be adequate, preferably in two sessions. Standardized tests would be first choices, administration and scoring ought to be objective and simple, and the material should be compact, and with enough variety to hold the interest of both subject and examiner.

In considering what functions one should test the recent work of Thurstone and Thurstone (2) was borne in mind. From repeated large scale studies they managed to isolate six " primary mental abilities " which they called : The verbal-comprehension factor V, the word fluency factor W, the space factor S, the number factor N, the memorizing factor M, and the inductive or reasoning factor R. To give a better balance to the scale a few simple motor tests were included.

SELECTION OF TESTS.

The first step was to look for reputable adult tests. Until recent years adult testing had received insufficient attention, but from about 1936 it began to come into the limelight. The work of Weisenburg, Roe, and McBride (3), and of Wechsler (4), are landmarks in this field, and items were selected from their scales.

A good deal of work has been done on mental " deterioration," and the following tests, most of which have been used for this purpose, were tried :

Babcock's Deterioration Scale, Rylander's Scale, items from the Terman and Merrill Scale, Bender's Visuomotor Gestalt Test, Cattell's Recognition of Designs and Nonsense Syllables, Picture Memory, and Colour Reversal, Dworetski's Pictures, Kohs' Block Designs, Porteous Mazes, Raven's Matrices, Trist's Progressive Shapes, the Shipley-Hartford Retreat Scale, Grace Kent's Oral Emergency test and her Written Tests for the clinic.

In all, nearly eighty short tests or items were tried before the present scale took shape. Only five of the Babcock tests were retained, the rest being discarded for various reasons, such as poor discrimination, too easy or too difficult material, timing difficulties—i.e. where separate items are timed—subjectivity of scoring, etc. All the Terman and Merrill items dropped out, mainly because the age range

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is too narrow. Some of these are, none the less, very useful clinically where insight into pathological mental function is wanted, e.g. Proverbs, Verbal and Pictorial Absurdities, Minkus Completion, Dissected Sentences, and Memory for Designs.

The above, and other relevant considerations, eliminated Kent's Written Tests, most of Rylander's Scale, two of Wechsler's Verbal Tests, and all except four of the others mentioned.

On the whole the battery is too long, and a shorter one, consisting of the items starred (Table I), is a useful combination. It should be emphasized that tests are the psychologist's tools, and his skill in using and interpreting them largely determines the quality of the results.

Subjects.

The 20 patients were seen in two London hospitals. Their ages ranged from 68 to 83 (median = 77 ± 4·5). Thirteen of the 20 were born in London and had spent most of their lives there. Vocationally, the group consisted of 1 professional, 1 skilled, 6 semi-skilled, and 12 unskilled workers.

In all cases the attitude towards the tests and the examiner were satisfactory. Occasional petulance and irritability were easily smoothed over. One or two became a little suspicious as to the purpose of the tests, and wondered if they had done something wrong or if they were to be transferred. These were told frankly

Table I.—*Tentative Test Battery for Seniles, showing Order of Presentation and Estimated Time in Minutes.*

No.	Test.	Time.	Average M.A.
1	Information: Personal	..	..
	Impersonal	..	..
1	Photographic recognition	4	..
2	*Picture memory	1	..
3	*Reading speed (monosyllables)	1	9·5
4	*Naming months forward	..	12·5
5	*Naming months reversed	1	11·5
6	*Repeating digits forward	..	(14·5)
7	*Repeating digits reversed	1	(11·5)
8	*Recall of paragraph—immediate	2	9·5
9	Block designs (Kent)	..	7·5
10	*Colour naming	..	..
11	*Colour reversal	3	..
12	*Recall of paragraph—delayed	2	7·0
13	*Vocabulary	8	..
14	Tapping	4	..
15	*Cube imitation	2	..
16	*Naming animals	1	..
17	*Naming birds	1	..
18	*Arithmetic	4	..
19	Tracing—letter "S"	1	..
20	Tracing—star	1	..
21	*Maze tracing	5	7·5
22	Writing speed—name	1	..
23	Writing speed—"U.S.A." (in full)	1	..
24	*Cube packing	3	..
25	*Sentence memory	4	11·5

The tests were derived from the following sources:

Tests 2, 10, 11, 15: Cattell, R. B. (1936), *Guide to Mental Testing.*

Tests 3, 21: Burt, C. (1921), *Mental and Scholastic Tests.*

Tests 4, 5, 8, 12, 22, 25: Babcock (1930), *An Experiment in the Measurement of Mental Deterioration.*

Tests 6, 7, 13, 18: Wechsler, D. (1939), *Measurement of Adult Intelligence.*

Test 14: Burt, C. (1909), *Brit. J. Psychol.*, **3**, 94.

Test 23: Downey, J. (1923), *The Will-Temperament and Its Testing.*

Tests 1, 16, 17, 19, 20, 24: cf. p. 370 of this article.

Test 9: Kent, G. H. (1934), *J. App. Psychol.*, **18**, 578.

The tests marked * form a useful shortened scale which takes about 40 minutes.

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that we wanted to compare their efforts with those of younger men. On the whole, the patients seemed to enjoy the incursion into their daily routine, and the project gave them another topic of conversation. From the writer's point of view they were as interesting to test as children.

Treatment of Results.

As the scale is a mixture of standardized and unstandardized tests, scores were converted into ranks, both on each test and on the full scale; the Spearman rank difference formula was used to calculate the correlation coefficients, which were afterwards transmitted into product-moment coefficients.

Estimates of the mental status of the patients were made in two ways, neither of them being very satisfactory. Firstly, mental ages were computed on eleven of the tests. This notation is obsolete for adults, but it has some use here for comparison with previous work on the decline of mental functions.

Table II.—*Order of Difficulty in the Tests and Comparison with Previous Findings.*

Present scale.	Previous results.	
(A) *Most Difficult.*		
Arithmetic, Wechsler	Analogies	Army Alpha.
Colour reversal, Cattell	Arithmetic	..
Cube imitation, Knox	*Associations, hard	Army Alpha.
Digits reversed, Wechsler	" Commonsense "	Army Alpha.
Mazes, Porteous	*Directions, hard	..
Months reversed, Babcock	Digit-symbol	Woodworth-Wells.
Paragraph memory, Babcock	..	..
Picture memory, Cattell	..	..
Reading speed, Burt	*Gestalt completion,	Bender.
	*Memory for designs	..
	Number completion	Army Alpha.
	*Paragraph recall	..
	Picture arrangement	Wechsler.
	*Digits reversed	Wechsler.
	Similarities	Wechsler.
	Also " logical procedure, organization, speed, and recall of unfamiliar material."	
(B) *Moderately Difficult.*		
Block designs, Kent	*Associations, easy	..
Digits forward, Wechsler	Arithmetic	Army Alpha.
Naming animals and birds	*Counting backwards	Babcock.
Sentence memory, rote, Babcock	Directions, oral	Army Alpha.
Vocabulary	*Digits forward	Wechsler.
	Dissected sentences	Army Alpha.
	*Feature profile	Wechsler.
	*Information	Wechsler.
	*Sentence memory	..
	*Vocabulary	Wechsler.
	*Block design	Wechsler.
(C) *Least Difficult.*		
Colour naming, Cattell	Comprehension	Wechsler.
Cube packing	Opposites	Army Alpha.
Photo recognition	Picture completion	Wechsler.
Tapping	Synonyms	..
Tracing	(Vocabulary)	Wechsler.
Writing, name, etc., Babcock	(Information)	Wechsler.

Tests marked * are classified by Wechsler, roughly, on the basis of various published studies and his own experience. They relate to the measurement of senile dementia.

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Secondly, weighted scores on the three "Bellevue" tests were averaged and I.Q's. calculated from Wechsler's conversion tables (verbal scale). Two sources of error come in here: (*a*) Three tests instead of five were used for I.Q. estimates, and (*b*) the figures were derived by extrapolation as Wechsler's highest age group is 55 to 59. The errors in I.Q's. are not likely to be more than a few points either way.

As a list of raw scores or ranks would not be very illuminating, mental ages for the appropriate tests are shown in Table I.

Table II shows the approximate order of difficulty in the 25 tests and a comparison with previous findings. This difficulty order was based on an analysis of the following criteria:

(1) Correlation with age within the group—bearing in mind that chronological age is not the only determinant of senility.

(2) The score variance in the different tests; which is partly a function of content, length, method of scoring, etc.

(3) The extent to which the tests discriminate between degrees of dementia, i.e. as between the two groups of patients.

(4) Relative mean scores, viz. mental ages.

(5) Proportion of failures.

(6) Correlation of the various tests with the full scale.

The results shown in Table II will be discussed from the point of view of different functions.

Table III shows the patients' I.Q's., together with estimates of the present mental efficiency of each patient as compared with the average level for ages 20 to 24, which Wechsler found to be the peak ages on his Bellevue scale.

Table IV gives the correlation of each test with age and with the full scale.

TABLE III.—*Estimates of Present and Former Mental Status of Twenty Senile Patients from Three "Bellevue" Verbal Tests.*

Subjects.	Age	Estimated intelligence quotients.	Estimated efficiency quotients.	Estimated efficiency quotients (vocabulary).
1	70	128	142	149
2	83	101	79	117
3	79	116	113	138
4	78	91	60	43
5	81	104	85	149
6	72	105	91	106
7	73	110	102	117
8	69	96	74	106
9	74	105	91	149
10	71	86	45	64
11	82	99	64	96
12	77	125	132	149
13	68	119	123	138
14	80	124	127	170
15	82	117	113	138
16	80	101	68	85
17	76	99	68	85
18	69	126	138	138
19	73	81	36	53
20	77	95	60	64
	Av. = 76.	Av. = 106.	Av. = 91.	Av. = 113.

RESULTS.

It will be noticed that the results of this experiment in regard to difficulty order agree substantially with those of previous investigators (Table II). Briefly, the present group of seniles found it difficult to reverse old habit sequences, to retain visual and auditory material of a meaningful kind, and showed impairment in such qualities as judgment, planning, and spatial discrimination.

They were somewhat better at rote memorizing, and in fluency of old associations.

They showed up best on immediate recognition (visual), early acquired habit

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TABLE IV.—*Correlation Between Each Test and* (A) *Age*, (B) *Full Scale.*

Test No.	Correlation with age in the present group.		Correlation with full scale.
1	+·44		+·29
2	+·07		+·54
3	−·41		+·55
4	−·67		+·59
5	−·62		+·76
6	−·28		+·66
7	+·03		+·75
8	−·07		+·56
9	−·63		+·67
10/11	−·01		+·66
12	−·26		+·61
13	+·07		+·70
14	−·42		+·43
15	−·26		+·38
16	−·02		+·70
17	−·06		+·78
18	−·08		+·58
19/20	−·24		+·73
21	−·16		+·86
22/23	−·28		+·71
24	−·21		+·66
25	−·07		+·76
All tests	−·27	All tests *v.* Bellevue	+·71
		All tests *v.* Babcock	+·79
		All tests *v.* memory tests	+·57

patterns, and simple motor tasks. It should be emphasized that these results are merely pointers to the *kind* of functions concerned. Apart from the fact that similarly named tests do not necessarily measure the same thing, any test can be made easier or harder by altering the number and kind of items, or the method of presentation.

The 25 tests were ranked in order of difficulty on each of the criteria mentioned. Since these rank orders did not run in parallel the estimates in Table II were obtained by considering each test in relation to all the criteria, and from observations made at the time of testing.

The correlation of −·268 between scores on the full scale and age within the group gives some indication of the more rapid decline of functions in old age. The writer found correlations little more than zero on a number of adult tests between the ages of 20 and 45.*

We can now discuss the above results in more detail.

The importance of ATTENTION was stressed by Rylander (5) in his study of frontal lobe tumours, and he used preliminary tests which purported to measure attention. Since no test really isolates this factor his example was not followed here. It was considered of more importance to build up a good rapport from the start. Straying of attention is more marked in seniles than in young people; they tend to lapse into a " brown study " or into reminiscence quite easily and have to be recalled to the test situation. To this they usually submit quite readily.

COMPREHENSION is a complex function, compounded of attitude, attention, memory, level of intelligence, sensory status, etc. It became evident that oral questions and instructions must be kept short, as the retention span is considerably curtailed, and repeating questions alters the standardization of the tests. Simplicity of visual material is also indicated for the same reason.

The decline of REASONING power was demonstrated in the preliminary stages, when a larger number of tests was in use. Unless one gave a good deal of prompting the patients were unable to do much with such tests as Burt's Reasoning Tests,

* The senile group is too small for really reliable correlation coefficients.

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Raven's Matrices, Kent's Essential Properties, Shipley's Abstraction, etc. Categorical thinking showed up badly on the sorting tests, e.g. Rothman's Test, using various articles of common use, and a test of shapes. If one is to use such tests on seniles one must have either a simpler version with short instructions, or use a carefully worked out prompting technique with a secondary measure of the amount of help required by the subject. This method has been explored successfully by Trist (6) in testing G.P.I's. The only reasoning test in the present battery is the arithmetic test from the " Bellevue " scale, which is quite suitable for seniles.

MEMORY tests were affected to some extent by sensory impairment, but none of the patients failed on this account, and if we are to measure senility we cannot exclude factors which are part of the process. Visual recognition appeared to show up better than visual recall, as one would expect, although no strict comparison is possible and both subjects and items are few. Rote memory was much better than logical memory, which suffered severely. In the recall of the Babcock paragraph (both immediate and delayed) all the mechanisms noted by Bartlett (7) occurred, e.g. omissions, elaborations, displacements, condensations, dramatizations, etc. The Babcock item is rather dull, however, and a more interesting paragraph with a similar number of " ideas " showed a better recall. The latter has not been included in the scale as it has no standardization.

FLUENCY and speed of associations is partly a function of the material used. Old rote habits, like naming the days of the week or months of the year, hold up well, though subject to a general retardation in senile functioning. In all the fluency tests there was markedly more blocking (longer and more frequent gaps in production) than in younger people. The only test in this section, where there was occasional forgetting of the task, was colour naming, but this was partly due to competition from some of the test material which the subject is required to ignore.

The SPATIAL factor was studied by the use of such tests as Kohs' Blocks, Progressive Matrices, and Porteous Mazes. The first two seemed to be too difficult to give sufficient variation of scores, apart from being rather long. Most of the block designs employ two-colour blocks divided diagonally, and the patterns are half size with no dividing lines between the blocks. This created difficulty for the seniles, some of whom seemed to become immobilized, whilst others rang the changes on a number of queer constructions. Goldstein (8), faced with a similar difficulty in cases of schizophrenia and cerebral lesion, used a progressive prompting and facilitating technique, This method is enlightening to the clinician, but the writer found it far too long, and therefore substituted a set of full colour designs used by Grace Kent, primarily on children. These proved to be about the right level, and showed quite a good variation in scores. In the Matrices test the subjects seemed to be rather bewildered when they reached the more conceptual part (late in Set B), and required undue prompting. Because of their failing sight they tended to complain of blurring of the patterns.

Porteous Mazes turned out to be one of the better tests in the scale, and gave another justification of its thirty years' existence. It has the highest correlation with the total scale, and a wide range of scores. Ranking these scores in order shows a steady linear drop through the series. The performances were interesting to watch: all the reactions mentioned by Porteous (9) and Brody (10) came out. A dynamic test such as this, where the subject's thinking is translated into action, is useful. (The reader is referred to chapters 3 and 6 of Porteous's *The Practice of Clinical Psychology*.) It is interesting that in a study of vitamin B deficiency (where some of the symptoms are similar to those of senility) by O'Shea, O'Shea and Higbe (11), it was shown that impaired maze performance was the one significant manifestation of deficiency, and the authors claimed to be able to assess the degree of deficiency by the amount of impairment in the maze performance.*

In the MOTOR tests both speed and steadiness were impaired. In senile patients, who are, in a sense, out of life's main stream, the time set is weakened, and the writer had to stress, in the timed tests, that they were to be done as quickly as possible. Some cases showed marked unsteadiness and disturbance under this imposition, and there was often a long warming-up period in which performance was rather poor and scanty. The time set would often fade during a test and have to be reasserted. In general, the senile likes to go along at his own pace and is disturbed by any interference with his routine. In the tests he may wander from

* Unfortunately these results were only on a few cases.

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the point or " play about." There was noticeable awkwardness in the handling of materials, with slowness, and tremors, due to decline of neuromotor facility, stiff joints, oedema, etc., as well as to emotional upset. Whilst it may be true that old people are less emotional, the test situation, especially if timed, may throw them out of gear. There was a low correlation between speed and steadiness —some patients were steadier when working quickly, others when they slowed down. The problem of individual differences in tempo is important in modern life, and the disturbances due to enforced tempo have not been sufficiently studied. They can be studied particularly well in old people.

It now seems to be established beyond question that VOCABULARY holds up well with age, and is useful as an index to " previous level," though there seems to be some vagueness as to what is meant by " previous." Where a pathological process is slow and insidious the time of onset is not easy to determine ; it may well be many years back. I have shown elsewhere (12) that the use of the vocabulary score as an index of pre-morbid level is not always justifiable. Much depends upon a person's background and interests. As between vocabulary and, say, non-verbal tests one is apt to find about as many discrepancies in scores the one way as the other—in adults at any rate. This means that in some cases another ability may serve better than vocabulary, especially in illiterates and people of low " intelligence " with practical ability. In a fairly recent study (13) the vocabulary (Terman and Merrill) growth curve was markedly different from curves of other tests in that it showed a late peak, i.e. at about the age of 55. If, therefore, a young person is being tested for possible deterioration his vocabulary ability will almost certainly be in the growing stage, whilst many other abilities may have reached their peak. In the present scale 12 out of the 20 patients had higher ranks on the total scale (excluding vocabulary) than on vocabulary alone, although the latter test showed up better than other *verbal* tests. The correlation of a vocabulary with a battery depends upon the kind of tests in the latter. In the present scale there were 14 non-verbal tests, yet the correlation was +·70. The vocabulary test does justify its inclusion, especially if it is one of the definitive kind, where the responses, if recorded verbatim, can be so valuable clinically.

One of the main findings of recent work on mental deterioration is the inability of many " organic " cases to shift from one mental attitude to another, especially from a concrete to an abstract attitude, a lack of resilience which often requires a strong pull to bring about the necessary movement. PERSEVERATION is an aspect of this rigidity, though most of the tests so far used to measure it have appeared to be unsatisfactory. In this study the forward-reverse type of test brought out senile inelasticity very well. In all three of these tests (colour reversal, reversing months and digits) there was a considerable discrepancy between forward and backward scores in terms of amount done or time taken. The more firmly established the habit the more difficult it is to break, hence reversing months shows a greater per cent. loss than does reversing digits. In the colour test the forward part itself is not easy for seniles ; the reversal is very revealing to the observer, as also is reversing months. Blocking, hesitancies, retracing steps, reverting to the forward sequence, and other signs of disturbance appear.

Tests 16 and 17 (naming animals and birds) were placed in apposition with the idea of bringing out perseveration, but it failed in the present group, whilst succeeding in the more demented group.

Perseveration occurs in dementia not only within tests but also between tests, and a changing scene or a variety of different items may be relied upon to produce it. Cameron (13) found, in patients suffering from psychoses of the senium, a greatly increased tendency to perseverate, which interfered with the registration of material, and which, allied to interference with retention by secondary elaboration, contributed to impoverishment of recent memory.

The problem of estimating former mental status presents difficulties, as mentioned. It would be of great assistance to have a number of curves showing the rise and fall of scores from early years to old age on a variety of tests, perhaps for different levels of ability. They should be triple curves, i.e. showing mean and deviation scores. In the present group the two measures of present status available are, as stated, mental ages and I.Q's. on some of the tests. As far as mental age is concerned, Jones and Conrad (14) reported a recession to an average mental age of 14 by the age of 55. Wechsler, in recommending chronological age (adult

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M.A.) denominators for use with the Terman and Merrill scale, suggests M.A. 12 for ages 55 to 59. This estimate is based on his composite age curve for the "Bellevue" scale. The average age for the present group of patients (ages 68 to 83) is between 10 and 11. It is obvious that age curves differ according to the kind of tests used, and the mental age method is much less useful than such measures as percentiles or standard scores. Most English adult tests are now scored in percentiles.

In terms of I.Q. the median score of the seniles is 105 ± 10 points. A rough estimate of the intelligence level on the three "Bellevue" tests at the peak ages of 20 to 24 raises the figure to 113 ± 8 points. According to Wechsler's tables the decline in I.Q. with age is greater as one goes down the scale of intelligence, so that, other things being equal, the more intelligent people will preserve their mental functions longer. This seems to be confirmed by observation and in the present investigation. An alternative and probably better estimate of the present level of the seniles relative to younger people was made from Wechsler's table of efficiency quotients (p. 195). An E.Q. of 100 means that an individual's score is on a par with the average score for the peak ages of 20 to 24; an E.Q. greater than 100 indicates a higher efficiency, and an E.Q. less than 100 a lower efficiency than the peak average. The estimated E.Q's. of the seniles range from 42 to 78 (average = 61), so that, subject to small errors of estimation, there is an approximate loss of efficiency in the present group of old people of about 39 per cent. on the average, and on the three tests concerned. The rather doubtful procedure of estimating E.Q's. on vocabulary score alone gave a range of 44 to 80 (average = 69), i.e. an approximate drop of about 31 per cent. from the peak.

Gilbert (15), in a comparison of the performance of 20-year-old with 60-year-old males—matched for vocabulary tests—reported "losses" in the latter group varying from 8·5 per cent. to 60·4 per cent. (mean 35·5 per cent.) according to the kind of test. The difficulty-order shown by her tests was substantially the same as in the present study.

An attempt was made to compare the variability of scores *within* individuals in the present group with the variability *between* individuals on the full scale of tests. The probable error of ranks was used as a measure of scatter, and the results of all the patients (38) were used. The figures for the present group were abstracted, and the results showed the proportion of intra- to inter-individual variation to be approximately 85 per cent. This figure is not significantly different from the figure of 80 per cent. found by Hull (16) as the result of a similar comparison.*

There was a definite tendency for the older people in the present group to "scatter" more ($r = +·43$), also for greater variability in the low scorers ($r = -·53$).

It was necessary in this investigation to keep the conditions of testing as ordered as possible, but experiment showed that a better clinical assessment accrued from using fewer tests and "exploiting" them to the full. Many of the items in the battery are particularly suitable for such usage, and the writer has since used the method with interesting results, following the example of Earl, Guttmann, Zangwill *et al.*

As a curtain raiser to the tests the subjects were asked a few questions about themselves and their affairs, and some items of general knowledge, as follows:

Personal.—Full name, age, birthday, date of admission to hospital, last address, names, ages, and birthdays of wife and children if married, or of siblings if single, name of school with age and status on leaving, occupations, names of employers, hobbies, interests, and work in the hospital.

Impersonal.—Name of present Prime Minister and of his precedessor, dates of the last war, date on which the present war started, date of Armistice Day, dates (month and year) of the invasion by Germany of France and Russia.

All were able to give promptly such items as their names, names of wives, children, or siblings, last address before entering hospital, name of school, leaving age and status, often with names of teachers and schoolmates, and jobs held between leaving school and retirement with names and addresses of employers.

All except four knew their birthdays, but there were mistakes as to the year of birth. Ages and birthdays of families were less firmly established.

* Hull's results were derived from a battery of 35 tests given to 107 American High School students. His measure of variance was the Standard Deviation.

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There were no mistakes in naming the Prime Minister, but four failed to name his predecessor correctly, giving names such as Baldwin, Ramsay Macdonald, Lloyd George, and Asquith.

The dates (months and years) of the last war were correct in all but four cases, but the date of the beginning of the present war was poorly recalled—six subjects gave the wrong year (e.g. 1937, 1938, 1941), and all except five failed to give the month correctly. It was perhaps too optimistic to expect the invasion dates to be recalled—only three gave the correct year and none the correct month.

On the whole names and places were recalled much better than dates and figures; this seems to be the case with most people. It occurs in patients recovering from electrical convulsions when one is checking information obtained prior to the fit. Personal memories were superior to impersonal in amount and accuracy; and whilst most of the patients could recall scraps of conversation from my previous visit, only one or two could recall, without prompting, oral material out of the previous test session. Again, remote memory was better than recent, and the flow of reminiscences had to be kept in check.

Most of the patients read at least one daily paper; a few were fairly heavy readers and regular borrowers from the hospital library. The majority wore glasses for reading, and a common complaint was that they needed "stengthening." Few appeared to have personal hobbies or interests other than the wireless, reading, dominoes, or cards. All were up and about and mostly did work in the ward or garden.

As far as could be ascertained from the case-notes and from questioning all the patients were correctly orientated for time and place, e.g. they knew the day, month and year, time of day, name and location of the hospital, names of other patients and hospital staff. Less than half gave correctly the date of their admission to hospital or the date of the test. On the whole one day is very much like another to them, and there is less need or incentive to remember dates, times (except mealtimes) and other data to which people "outside" have to pay attention.

References are given in Table I for most of the tests in the scale, but the following six tests, introduced by the writer, call for a brief description.

Test 1: *Photograph recognition.*

This consists of twelve black and white photos of middle-aged men. They are uniform in size and clarity, and are numbered, the first four being used for individual presentation. In Part 1 the photo (No. 1 first) is shown for 30 seconds; it is then shuffled with the others and the subject is asked to pick it out. This is repeated for the other three photos. The cards are left in the pack after each presentation, with the object of bringing out perseveration, indecision, confusion, etc.

In Part 2 the subject is asked to select from the pack the four photos, in order if possible. (He can be warned at the beginning to expect this—or not—so long as one procedure is followed with all subjects.) The test was not difficult enough to give a good score variation, but could be made so by increasing the number of cards presented to six. This technique is better than presenting half the material at once and asking the subject to separate it from the rest (as in Babcock's method)—it leaves less to chance.

Test 16: *Naming Animals.*

After a trial with the conventional word-association test it was decided that the situation needed more control because of possible emotional blocks in "free" association, and the different degrees to which subjects make use of their immediate environment (this could be obviated to some extent by getting subjects to close their eyes). The subject is asked to give the names of as many animals as he can think of in one minute. The results were satisfactory and gave a good scatter.

Test 17: *Naming Birds.*

As in Test 16.

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Test 19: *Tracing.*

The subject was given a sheet of paper on which was a large letter " S " composed of dots a quarter of an inch apart; he was instructed to trace the outline by drawing through the dots and to do it as quickly as he could. Time and errors were recorded. On the whole the test is not to be recommended as the errors are not easy to assess.

Test 20: *Tracing.*

For this test an eight-pointed star was used instead of a letter " S." It has the same disadvantage as Test 19, i.e. as to error assessment, but it is better in other respects. It requires the subject to make nine changes of direction in tracing—in vertical, horizontal and diagonal. Most of the patients tried to make the test easier by turning the paper, but this was not allowed.

It is quite a good test of combined speed and steadiness and it brings out motor disturbance—both primary and secondary, i.e. due to emotional disturbance.

Test 24: *Cube Packing.*

The material consists of a wooden box, 4 by 4 by 3 in. deep (or a little over to allow the blocks to fit readily), and 48 1-in. cubes. The subject has to pack the cubes in the box—in three layers—as quickly as he can. The time is recorded.

Even in such a simple test motor disturbances occur, as well as different ways of handling and packing.

Dexterity in handling cubes is also a prime factor in the block design test, which employs easy, full colour designs. The correlation between that test and the present one is +·58.

Summary.

A tentative battery of 25 short tests for the measurement of senescence is described (*cf.* Table I). The scale is the result of the application of nearly 80 tests to senile patients in three London hospitals. It was administered in full to 38 patients in all, and the present findings refer to a group of 20 less seriously demented ones, with an age range of 68 to 83.

The tests are classified into three groups according to the degree of difficulty experienced by the seniles (Table II). The divisions were made on the basis of a number of criteria which emerged during the working up of the results, and are only pointers to the kind of functions involved. Briefly, the most difficult tests were those in which subjects were required to break away from old mental habits and adapt to unfamiliar situations, tests of recent memory (logical), of judgment, planning, and reasoning, or embodying difficult or lengthy instructions. Less difficulty was found with such tests as rote memory, fluency of associations, simple arithmetic, and vocabulary. Performance seemed to be least affected on tests of visual recognition, old mental habits, and simple motor tasks.

It is shown that tests for senility should be short, especially those with oral questions, because of straying attention, impaired comprehension, and short retention. Perseveration is greatly increased in senescence; it can be brought out merely by having a succession of short, varied items. There is a loss of steadiness and speed on the motor side. The disturbing effect of tests with a time element on the slower acting senile is noted.

The present mental status of the patients is estimated on eleven tests which are scored on the (outmoded) mental age method (Table I): the average of these is between M.A. 10 and 11. This figure is compared with previous reports on the decline of intelligence.

An estimate of the former mental status of each patient is made by means of efficiency quotients on part of the " Bellevue " scale. These relate each score to the average level for the peak age-group of 20 to 24 years (Table III).

The use of the vocabulary score as an index of former level is discussed.

A comparison of score variation *within* individuals with variation *between* individuals shows a ratio of the former to the latter of approximately 85 per cent.

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Variability of scores within individuals increases with age inside the patient group, also with lower intelligence.

A shortened version of the scale, which takes about 40 minutes, is indicated (Table I).

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RESULTS OF SHOCK THERAPY EVALUATED BY ESTIMATING CHANCES OF PATIENTS REMAINING IN HOSPITAL WITHOUT SUCH TREATMENT.

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1. INTRODUCTION.

THE problem of estimating objectively the value of any new form of treatment is constantly presenting itself in all branches of medical work. In the case of shock therapy applied in the treatment of mental disease, the task is especially difficult. Standards of initial severity and degrees of improvement in mental diseases are subject to very wide interpretations. Disagreement on questions of diagnosis is common even among psychiatrists who employ the same terminologies. Thus, it is not surprising to find that widely divergent claims have been made about the value of shock treatment in mental diseases. In most of the large surveys, patients have been classified as (i) Recovered, (ii) Much improved, (iii) Improved, or (iv) Unimproved after shock treatment, but little unanimity about the results has emerged. In Table I, the figures given by Malzberg (1938) and Pollock (1939) for New York State and those for Ohio, given by Bateman and Michael (1940), are compared with figures obtained in a survey of the Ontario Mental Hospitals in 1941.

TABLE I.—*Results of Shock Therapy as given in some Large Surveys.*

Area.	New York.		Ohio.		Ontario.	
Date.	1938–1939.		1940.		1941.	
Type of treatment.	Metrazol.	Insulin.	Metrazol.	Insulin.	Metrazol.	Insulin.
Numbers of patients :						
(i) Recovered	18	134	88	130	422	57
(ii) Much improved	113	282	199	116	221	37
(iii) Improved	279	263	72	54	176	27
(iv) Unimproved or died	730	360	220	116	517	75
Total	1,140	1,039	579	416	1,336	196
Percentages of patients :						
(i) Recovered	1·6	12·9	15·2	31·2	31·6	29·1
(ii) Much improved	9·9	27·1	34·4	27·9	16·5	18·8
(iii) Improved	24·5	25·3	12·4	13·0	13·2	13·8
(iv) Unimproved or died	64·0	34·7	38·0	27·9	38·7	38·3
Total	100·0	100·0	100·0	100·0	100·0	100·0

The percentages of recoveries are seen to vary so widely that the inadequacy of this attempt to evaluate the treatments is at once apparent. To determine whether or not shock therapy does any good, a method of estimating the prospects of spontaneous recovery, in the group of patients concerned, is required. In mental disease there is fortunately one definite index obtainable, which is closely related to improvement or relapse, namely, the fact of the patient's discharge from hospital or, conversely, the patient's presence on its books. In the province of Ontario, records of all the patients who had ever been admitted to provincial mental hospitals, were available at the central office. This circumstance suggested the possibility

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of making out standard expectancy tables for patients' remaining in hospital. Accordingly, in the survey which is reported here, an attempt is made to estimate the value of shock treatment on a new basis. The essence of the new method is the comparison of the actual number of shock treated cases, remaining on the hospital books at a given time, with the expected number, calculated from a random sample of the mental hospital population.

2. The Control Group.

Discharge, rather than probation, was taken as the index for comparison of treated and control cases. In Ontario it is customary for patients to be sent home on probation for a period which rarely exceeds six months before they are discharged. The date of going home, however, could not be conveniently ascertained for large numbers of cases and a probated patient is still under hospital supervision. Since the death of a patient is only recorded in the files, if it occurs while the patient is on the hospital books, it was more accurate to estimate the probability of being on the books than the probability of being alive and discharged. To estimate the probability of being alive and discharged would have entailed estimating the death rates of discharged patients. Unless the death rate for discharged treated patients differs markedly from that for discharged untreated patients, there is no need to make any allowance for deaths when using the present method.

Several attempts have been made to arrive at control figures for comparison with statistics of treated cases, notably by Guttmann, Mayer-Gross and Slater (1939), Bond (1941) and Ziskind and others (1942). It has been generally assumed, that the matching of clinical types by diagnoses is essential and, consequently, an arbitrary factor enters into the calculations. There is, however, an indirect method of matching diagnoses available because, as has been demonstrated by Dayton (1940), a close relationship exists between age at the time of first admission and diagnosis, especially when the sexes are separated. In preparing tables of expectation for mental hospital life, therefore, age on first admission and sex were both specified. The effectiveness of such procedure in specifying diagnosis can be judged by reference to Table II and Chart I. Patients first admitted below the age of 20 years to mental hospitals are likely to be defective. Those first admitted between the ages of 20 and 40 years are most commonly diagnosed schizophrenic. Patients first admitted between the ages of 40 and 60 are most likely to be classified as manic-depressives or as involutional cases and those admitted after the age of 60, organic or senile cases.

Table II.—*Relationship between Diagnosis and Age : First Admissions to Ontario Hospitals* (*4-year Aggregate* 1939–42).

Most recent diagnosis (both sexes).	Age on first admission.								All ages.
	0–10.	10–19.	20–29.	30–39.	40–49.	50–59.	60–69.	70+	
Defective	292	702	294	150	107	57	15	2	1,619
Epileptic	48	160	120	87	60	51	16	4	546
Defective and epileptic	340	862	414	237	167	108	31	6	2,165
Schizophrenic	0	189	759	649	403	176	81	14	2,271
Affective	0	50	224	302	396	456	180	30	1,638
Non-psychotic	1	55	171	287	231	143	58	12	958
Affective and non-psychotic	1	105	395	589	627	599	238	42	2,596
Organic and other	0	27	139	280	355	423	617	948	2,789
Total	341	1,183	1,707	1,755	1,552	1,306	967	1,010	9,821

N.B.—The peak for first admissions of defective and epileptic patients falls within the age group 0–19 years, that for schizophrenia in the age-group 20–39 years. The peak for first admissions of manic-depressives and involutional cases falls in the age-group 40–59 years, and other cases, including those diagnosed organic psychosis, are mostly admitted after the age of 60 years.

A further point of importance is the matching of length of stay in hospital for control and treated patients. Not infrequently it has been assumed that patients treated soon after first admission are more likely to be favourably influenced than those in whom treatment is deferred. The correctness of this assumption is doubtful, because, in consequence of the general tendency of patients who recover

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quickly, to leave hospital, the group which remains after a period of months or years is automatically selected as a group of cases with relatively unfavourable outlook. Our tables, therefore, were constructed to show the chance of a patient's still being on the hospital books at a given point of time in the future, when the age on first admission, sex, and length of time since admission were all taken into account. The manner of calculating these tables from a random sample, which was composed of 8,016 case histories of mental hospital patients in Ontario, has been described in detail in a previous publication (Penrose, 1943). First, the proportion of cases remaining in hospital after a given lapse of time was ascertained for the two sexes and for five age-groups—the findings are summarized in Table III. From

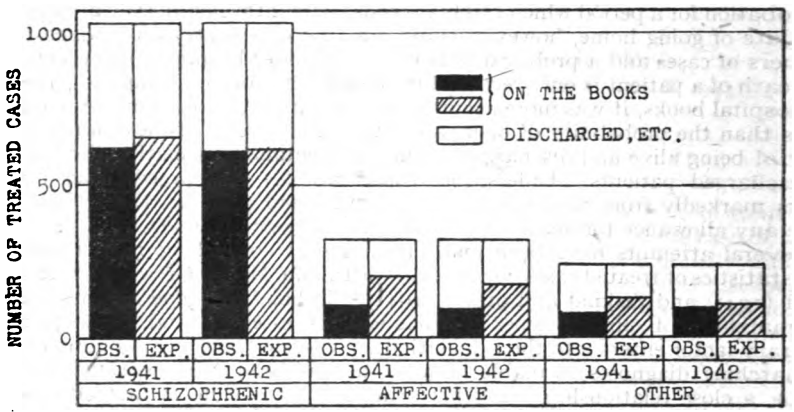

CHART I.

TABLE III.—*Percentages of Patients on Hospital Books* after a given Lapse of Time.*

Age on first admission.	Lapse of time since first admission. 1 year. Male.	1 year. Female	5 years. Male.	5 years. Female.	25 years. Male.	25 years. Female.
0–19	65	76	38	53	28	30
20–39	58	50	32	29	25	27
40–59	50	48	17	24	13	16
60–79	43	66	9	20	1	2
80+	29	70	0	0	0	0
All ages	52	57	23	30	18	20
All ages—both sexes	55		26		19	

* Some patients represented here will have been continuously in hospital all the time since first admission and others readmitted to hospital.

TABLE IV.—*Percentage Expectation of being on Hospital Books : Both Sexes—All Ages.*

Number of years since first admission date.	Number of years in future. 0.	0.	½.	1.	1½.	2.	2½.	3.	3½.	4.	4½.	5.
0 .		100	68	55	39	36	34	34	35	30	28	26
½.		100	72	57	53	50	50	52	44	41	38	37
1 .		100	79	74	69	69	72	61	57	53	53	53
1½.		100	92	86	86	90	77	72	67	65	67	66
2 .		100	92	92	94	81	77	71	71	71	75	77
2½.		100	96	98	87	82	76	74	76	78	82	84
3 .		100	98	87	82	76	75	76	76	82	84	86
3½.		100	84	80	73	77	73	81	80	86	84	87
4 .		100	92	85	83	85	83	92	93	96	93	92
4½.		100	91	92	91	94	96	98	98	98	96	95

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these figures it was possible to derive tables of expectations, like those shown in Table IV, in which the trend, for the likelihood of being in hospital to increase as length of time since first admission increases, is clearly brought out. Thus, for a first admission the chances of being on the hospital books (irrespective of age and sex) after one year's lapse of time are 55 in 100; but, if the patient under consideration was first admitted two years ago, there are 92 chances in 100 that he will still be on the hospital books in one year's time. The tables were all calculated for time intervals measured to the nearest half year.

3. The Treated Patients.

During the years 1938 to 1941, metrazol or insulin shock therapy or both were given to 1,600 in-patients of the Ontario Mental Hospitals. The group consisted of 741 males and 859 females and their ages ranged from 14 to over 60 years. Altogether, 1,041 of them were diagnosed schizophrenics, 322 were considered to be suffering from affective psychoses, i.e., manic, depressive or involutional reactions, and 237 were otherwise diagnosed (or diagnosis was not specified). The diagnosis, however, did not enter at all into the matching process, which simply involved finding the appropriate expectation of being in hospital for each patient, on a given date. The expectancy was then compared with the facts; that is to say, it was ascertained, in each case, whether or not the patient was on the hospital books at that same given date and this was recorded in a table like Table V.

Table V.—*Ascertainment of Actual Number of Shock-Treated Patients on Hospital Books as Compared with Estimated Number.*

Serial number.	Sex.	Age on first admission.	Lapse of time in years. First admission to first treatment.	Lapse of time in years. First treatment to Nov. 30, 1941.	Observed status.*	Expectation.
1	F.	36	0	1	0	0·50
2	M.	16	2	3	0	0·63
3	M.	19	2½	1½	1	0·96
4	M.	22	5	2½	0	0·98
5	M.	43	2½	2½	1	0·84
6	M.	34	0	1½	1	0·34
Total					3	4·25

* Observed status means whether or not the patient was on the hospital books on Nov. 30, 1941: here, "on the books" scores 1 and "discharged" or "died in hospital" scores 0.

The observed and expected values were added up and totals were obtained both for specified groups of patients and for all patients together. Theoretically the errors of the comparisons can be calculated by summing the sampling variances of the expectations. Such errors might, however, be misleadingly small, if based upon the usual formula for the variance of a fraction p, namely $p(1-p)$, for there are many unknown sources of inaccuracy in setting up the tables of expectations.

4. Results.

The net results of these calculations are shown in Table VI. The calculations were made twice, in November, 1941, and in November, 1942, for the same group of treated patients. The 1941 figures show the results after an average interval of about two years since commencement of treatment and the 1942 figures give the picture after three years. Thus, out of a total of 1,600 patients treated, 807 were still in hospital after two years, and after one year more 797 were still in hospital. The expected numbers of patients still in hospital, based on the control figures, were 984·1 and 906·1 respectively. There were, therefore, in November, 1941, 177·1 fewer patients on the hospital books than would have been expected had no shock treatment been given but, by November, 1942, there were only 107·1 fewer patients in hospital. For any given group of patients, normally, as each year passes, there is a gradual falling off in the number of those still on the hospital books. In the control group, during one year 1941–2, the falling off from 984·1 to

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901·1 was marked but, in the group of treated patients, the falling off in number is only slight, i.e. 807 to 797, and this probably indicates a tendency for treated patients to return to hospital after they have been discharged. After one year, 70 of the 177 patients whose absence from hospital could be attributed to shock therapy had apparently returned, and, in evaluating the net result, the possibility of other readmissions after November, 1942, should be taken into account. On the whole, however, the figures suggest that shock therapy has definite value in keeping a certain proportion of treated patients out of hospital for periods of time extending over one or more years: the proportion amounts to something between 6 per cent. to 11 per cent. of treated cases.

When different groups of patients were specified, some important differences were brought out, for example, among the very large number of cases diagnosed schizophrenia, i.e. over 1,000 cases, only 33 in 1941, and only one in 1942 could be supposed to have been discharges from hospital in response to treatment. Conversely, among cases with diagnosis of affective reaction type, the number on the books in both surveys was not much more than half that expected for the general run of patients admitted at the same ages (see Chart 2). The results of shock

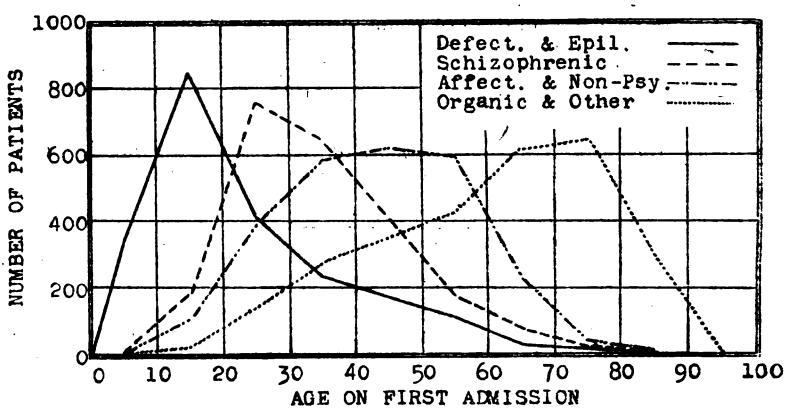

CHART II.

TABLE VI.—*Summary of Results, 1941 and 1942.*

	Number of cases treated.	(*a*) Observed number on hospital books.		(*b*) Expected number on hospital books.		(*b–a*) Patients on books as compared with expectation.*	
		Nov., 41.	Nov., 42.	Nov., 41.	Nov., 42.	Nov., 41.	Nov., 42.
Sex:							
Males	741	386	377	462·1	409·7	− 76·1	−32·7
Females	859	421	420	522·0	494·4	−101·0	−74·4
Type of treatment:							
Metrazol	1,333	661	644	842·2	768·4	−181·2	−124·4
Insulin	196	97	103	105·8	94·7	−8·8	+8·3
Both	71	49	50	36·1	41·0	+12·7	−26·3
Reaction type:							
Schizophrenia	1,041	621	609	654·2	610·3	−33·2	−1·3
Affective	322	103	95	200·4	174·5	−97·4	−79·5
Other	237	83	93	129·5	119·3	−46·5	−26·3
Total:							
Numbers	1,600	807	797	984·1	904·1	−177·1	−107·1
Percentages	(100·0)	(50·4)	(49·8)	(61·5)	(56·5)	−(11·1)	−(6·7)

* Negative values in the column indicate fewer patients in hospital than expected and are, therefore, favourable.

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treatment for cases with affective reactions appears to be very favourable—at least within the period of time covered by the survey. On the same basis of comparison, metrazol seems to have been the valuable method of treatment, not insulin, and females seem to have responded better than males to shock therapy. Since insulin was used almost exclusively for patients diagnosed schizophrenia and the majority of these cases were males, the results of the comparisons for different types of treatment and for the two sexes should not be too rigidly interpreted.

5. A Specific Test of the Method Used.

A control experiment for estimating the accuracy of the tables of expectations was made by taking, at one hospital, all the patients who had been recommended for shock therapy but who, for one reason or another, did not receive it. Some patients left hospital before treatment could be given, others were thought to be unsuitable on account of physical disabilities and a few were excluded on account of the long duration of their illnesses. Table VII shows that the observed and expected numbers of patients on the hospital books in November, 1942, agreed very closely in the untreated group. In this experiment, therefore, the total expectations are shown to be fairly accurate. It is of interest also to note that, in the treated group of cases at the same hospital, there were four patients fewer on the books than were to be expected. The low rate of improvement attributable to shock treatment at this particular hospital, as compared with some others was probably due to the choice of an unduly large number of cases in the younger age-groups for treatment.

Table VII.—*Summary of Results of Metrazol Treatment at one Hospital.*

Patients selected for treatment and consent obtained from relatives.	Sex.	Total number.	Observed number on books November, 1942.	Expected number on books November, 1942.
Treatment withheld	Male	70	49	46·28
	Female	11	5	7·61
Total		81	54	53·89
Treatment given	Male	88	48	45·02
	Female	104	63	70·00
Total		192	111	115·02*

* There were four cases fewer on the books than expected in the treated group, whereas for the untreated patients the observed and expected totals agree closely.

6. Comment.

The result of this method of analysis seems to give clear indication of the positive value of shock treatment in cases diagnosed manic-depressive or involutional psychosis, that is, mainly in cases first admitted between the ages of 40 and 59 years. Very little support is provided for the view, formerly widely held, that shock treatment has value in schizophrenia. If the expectations, calculated by the method reported on here, are appreciably in error, they are most likely to err on the side of optimism, since defectives and organic cases were not excluded from the control group. There is, moreover, no certain way of checking the possibility that cases, in which a favourable outcome is expected—even without shock treatment—are not preferentially selected for this form of therapy. Indeed, instances are known of cases being brought in to hospital for short periods, especially to take shock treatment, who, otherwise, could have remained at home. Again, in rare instances, patients may avoid readmission for fear of more treatment rather than because they have been cured by it. Taking all the facts together, however, it is probably safe to assume that, in consequence of the shock therapy work carried out during the years 1938 to 1941, there were at least 100 patients fewer on the books of the Ontario mental hospitals during the year 1941–42 than there would have been if no such specific treatment had been given.

The work described here represents an experiment in statistical method, which

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seemed justified by the importance and complexity of the problem of assessing the true value of shock therapy. No survey could be found in the literature to furnish an exact prototype and there are undoubtedly details in the method which could be improved. However, a set of control tables have been provided, by which the results of any special form of therapy can be judged from year to year. The writers wish to thank Miss A. Clarke for her assistance in preparing the data.

7. Conclusion.

Methods of evaluating shock therapy in cases of mental illness have been discussed and a new method has been briefly described. By this new method the number of treated patients who remain on the hospital books on any given date can be compared with an expected number based upon a control group of cases matched according to sex, age on first admission, and lapse of time since first admission. The results indicate that fewer shock treated cases remain on the hospital books than are to be expected from considerations of the control sample. An improvement attributable to shock treatment in patients' conditions is implied, which is very slight in cases diagnosed schizophrenia but marked in cases diagnosed manic-depressive and involutional psychosis.

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MALARIA IN NEURO-SYPHILIS 1923–43.

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Malarial therapy as a subject for a paper may well have lost the sparkle that it once owed to novelty, but it should still be acceptable if only because the passing of time and the accumulation of experience provide an opportunity of confirming some of the tentative conclusions originally advanced, of emphasizing what has often passed almost unnoticed, even of disproving opinions hastily formed on insufficient data.

This review of some twenty years' work does not attempt to discuss minor details of treatment or results. Rather is it designed to provide a general survey, paying special attention to long-term retrospect as a means of estimating the therapeutic effect of malaria.

Material.

Over 90 per cent. of the 604 cases were true general paralytics, the remainder consisting of tabo-paretics, tabetics, and a few cases of meningo-vascular syphilis with well-marked mental symptoms. Males outnumbered females by 12 to 1, so for the purpose of this survey all cases, of both sexes, have (except for Table I) been considered together rather than separated into sub-groups.

Some of these cases have been in more than one hospital. Thus 15 have been received here after discharge from another institution and 2 as direct transfers. Similarly, 28 have been sent from here to other hospitals (partly owing to war conditions) and 19 are there now. Rather than classing these separately they have all been included in the Tables as though they had been wholly resident in this hospital.

As the tables are self-explanatory only a few comments will be made, enough to emphasize the salient points that lead to definite conclusions.

Malaria.

Of the 604 cases under review, 424 were inoculated for malaria, but owing to immunity in some cases, or to death or to the administration of quinine during the incubation period in others, only 401 actually had malaria. An attempt to induce a second attack was made in 100 cases, but in only 81 was this successful, while only 15 out of 27 attempts resulted in a third attack. No fourth attack was produced in spite of inoculations performed to that end on 5 cases.

This difficulty of achieving a second attack of malaria is well brought out in Table II, but there is no doubt concerning the possible usefulness of inducing subsequent attacks when a satisfactory improvement has not followed a first. Thus 18 cases were discharged (or re-discharged) who would probably not have been fit to leave the hospital had they not had a second attack, two other cases being discharged as the result of improvements occurring after a third attack. And this in spite of the tendency for subsequent attacks to cease spontaneously, with the result that the average number of rigors achieved remains much below that desired and, more often than not, attained in the case of first attacks.

Intravenous and subcutaneous inoculations were early discarded, the intramuscular being the one preferred; mosquito infection was reserved for the introduction of new strains, or for the overcoming of the immunity that is sometimes encountered even in untreated patients.

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TABLE I.

Types and sex of cases.	Total cases.	All cases. G.P.I. M.	All cases. G.P.I. F.	All cases. Others. M.	All cases. Others. F.	All cases. Total. M.	All cases. Total. F.	Died. G.P.I. M.	Died. G.P.I. F.	Died. Others. M.	Died. Others. F.	Died. Total. M.	Died. Total. F.	Departed. G.P.I. M.	Departed. G.P.I. F.	Departed. Others. M.	Departed. Others. F.	Departed. Total. M.	Departed. Total. F.	Remaining. G.P.I. M.	Remaining. G.P.I. F.	Remaining. Others. M.	Remaining. Others. F.	Remaining. Total. M.	Remaining. Total. F.
Admitted	604	502	47	53	2	555	49	323	33	33	1	356	34	136	8	14	1	150	9	43	6	6	..	49	6
Inoculated	424	370	25	28	1	398	26	196	11	12	..	208	11	135	8	10	1	145	9	39	6	6	..	45	6
Successful	401	348	24	28	1	376	25	176	10	12	..	188	10	134	8	10	1	144	9	38	6	6	..	44	6
No malaria	203	154	23	25	1	179	24	147	23	21	1	168	24	2	..	4	..	6	..	5	..	..	..	5	..

TABLE III.

Attacks and rigors.	Attacks of malaria. 1 only.	2 only.	3 only.	Rigors in first attacks. 1–3.	4–6.	7–9.	10–12.	Total cases.	Adjuvants to malaria. None.	Pyrifer.	Tryparsamide.	Others.	Pyrifer + tryparsamide.	Pyrifer + others.	Tryparsamide + others.	Drugs.
All cases	320	66	15	34	84	163	120	401	193	4	104	54	2	1	43	Malaria.
	..	..	..	..	..	..	..	203	179	5	7	4	7	..	1	No malaria.
	320	66	15	34	84	163	120	604	372	9	111	58	9	1	44	Total.
Died	165	24	9	30	50	64	54	198	135	2	26	20	1	..	14	Malaria.
	..	..	..	..	..	..	..	192	175	5	4	3	5	..	..	No malaria.
	165	24	9	30	50	64	54	390	310	7	30	23	6	..	14	Total.
Departed	133	18	2	4	23	73	53	153	51	1	53	28	..	..	20	Malaria.
	..	..	..	..	..	..	..	6	..	..	3	1	1	..	1	No malaria.
	133	18	2	4	23	73	53	159	51	1	56	29	1	..	21	Total.
Remaining	22	24	4	..	11	26	13	50	7	1	25	6	1	1	9	Malaria.
	..	..	..	..	..	..	..	5	4	..	..	..	1	..	..	No malaria.
	22	24	4	..	11	26	13	55	11	1	25	6	2	1	9	Total.

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TABLE II.

Results and methods of inoculations.	Results in each class of attack. For first attacks. Successful.	Abandoned.	For second attacks. Successful.	Abandoned.	For third attacks. Successful.	Abandoned.	For fourth attacks. Successful.	Abandoned.	For all attacks. Successful.	Abandoned.	Totals.
After 1 inoc.	397	21	65	9	12	8	..	3	474	41	515
,, 2 inocs.	4	..	7	9	2	3	..	..	13	12	25
,, 3 ,,	..	1	5	1	1	..	..	1	6	3	9
,, 4 ,,	..	1	4	..	..	1	..	..	4	2	6
,, 7 ,,	..	..	..	..	..	..	..	1	..	1	1
Total cases	401	23	81	19	15	12	..	5	497	59	556
Total inocs.	405	28	110	30	19	18	..	13	534	89	623
Mosquito	51	6	6	1	..	..	..	..	57	7	64
Intramuscular	302	16	97	17	17	16	..	13	416	62	478
Intravenous	24	4	2	9	1	..	..	..	27	13	40
Subcutaneous	28	2	5	3	1	2	..	..	34	7	41
1–3 rigors	34	..	12	..	5	..	..	..	51	..	51
4–6 ,,	84	..	38	..	6	..	..	..	128	..	128
7–9 ,,	163	..	23	..	3	..	..	..	189	..	189
10–12 rigors	120	..	8	..	1	..	..	..	129	..	129
Average number of rigors	7·96	..	5·8	..	5·0	..	..	..	7·5	..	..

DRUGS.

The usefulness of drugs as an adjuvant to malaria has long been recognized, especially in relation to tryparsamide, which enjoys a specially favoured position as the drug of choice in neuro-syphilis. Apart from tryparsamide, however, other drugs have been used here, such as bismostab, bivatol, bisglucol, iodo-bismuthate of quinine, neo-salvarsan, stovarsol, sodium stovarsol and acetylarsan. As these have not been given systematically in controlled groups of cases it is not possible to discuss the efficacy of them individually, but it is of interest to note how the higher "departure rate" (including recoveries) amongst the cases receiving tryparsamide—as compared with that found in those treated by malaria only—is well matched by the corresponding rate in patients treated by one or more of the other drugs. This means that when there are contra-indications to the use of tryparsamide, adjuvant treatment by other preparations need not engender a prognosis that is any more gloomy than that associated with an unrestricted choice of drugs.

DEPARTURES.

The total departures numbered 153, or 38 per cent., in the malaria cases, while only 3 per cent. left among the others. The proportion of recoveries and improvements are shown in Table V, and the fact that even advanced cases can make good recoveries is evidenced by the number of recovered patients who had originally been admitted in a bed-ridden condition, or with wet and dirty habits, or with a history of seizures. Some of the discharges were subsequently readmitted, but a proportion of these readmissions were followed by a second discharge. Table IV, dealing with age-groups, shows how quite a satisfactory number of cases were discharged from among the higher age-groups, while it might be mentioned, in passing, that of the 148 cases alive now (both at home and in hospital) 29 have passed their sixtieth birthday; indeed, one patient now at home is 83.

TABLE V.

Departures (malarial cases).	Total.	Of which admitted. Bed-ridden.	Wet and dirty.	After seizures.	Later. Readmitted.	Re-discharged.	Now. Dead.	Alive.	Untraced.
All cases	153	52	40	16	36	9	45	93	15
Recovered	109	40	29	14	24	5	35	64	10
Much improved	31	6	4	1	6	3	4	23	4
Improved	9	4	6	1	4	1	4	4	1
Not improved	4	2	1	..	2	..	2	2	..

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TABLE IV.

Ages.	Age groups. Under 30	30–39	40–49	50–59	60 and over.	Total cases.	Years of residence in hospital to date or prior to death or discharge. 0–1.	1–2.	2–3.	3–4.	4–5.	5–6.	6–7.	7–8.	8–9.	9–10.	10–11.	11–12.	12–13.	13–14.	14–15.	15–16.	16–17.	17–18.	18–19.	19–20.	20–21.	Length of fesidence.
All cases	18	103	176	90	14	401	201	72	29	20	12	11	7	9	6	3	9	4	2	3	1	2	2	..	3	4	1	Malaria.
	12	42	72	64	13	203	168	20	3	3	3	3	..	2	..	1	..	..	..	..	..	..	..	..	..	..	..	No malaria.
	30	145	248	154	27	604	369	92	32	23	15	14	7	11	6	4	9	4	2	3	1	2	2	..	3	4	1	Total.
Died	5	47	82	58	6	198	108	24	19	13	7	7	3	4	1	1	6	1	1	1	..	1	..	..	1	..	..	Malaria.
	12	38	67	62	13	192	162	19	3	2	2	2	..	1	..	1	..	..	..	..	..	..	..	..	..	..	..	No malaria.
	17	85	149	120	19	390	270	43	22	15	9	9	3	5	1	2	6	1	1	1	..	1	..	..	1	..	..	Total.
Departed	10	39	72	27	5	153	90	43	8	6	1	2	2	..	1	..	..	..	..	..	..	..	..	..	..	..	..	Malaria.
	..	1	3	2	..	6	3	..	..	1	1	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	No malaria.
	10	40	75	29	5	159	93	43	8	7	2	3	2	..	1	..	..	..	..	..	..	..	..	..	..	..	..	Total.
Remaining	3	17	22	5	3	50	3	5	2	1	4	2	2	5	4	2	3	3	1	2	1	1	2	..	2	4	1	Malaria.
	..	3	2	..	..	5	3	1	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	No malaria.
	3	20	24	5	3	55	6	6	2	1	4	2	2	6	4	2	3	3	1	2	1	1	2	..	2	4	1	Total.

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Serology.

The serological changes to be expected after malaria must again be emphasized, if only on account of the misleading statements still made on the subject. For instance, in Kinnier Wilson's *Neurology* (1940) a return to a normal Lange curve after malaria is looked upon as " very unusual," but our experience here contradicts this. True that the Lange tests rarely show much change until some years have elapsed after the malaria, but, given time, normal curves are by no means uncommon.

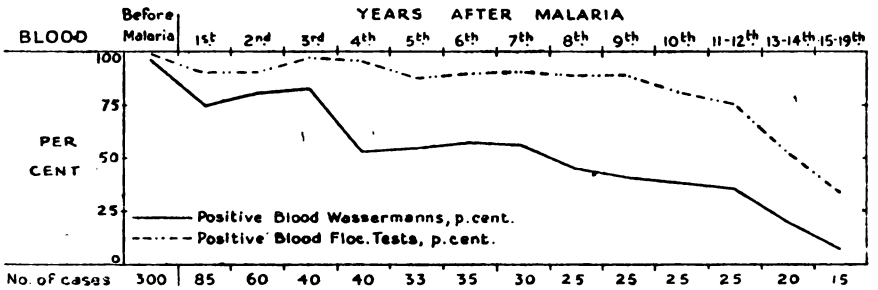

Chart 1.—Wassermann and flocculation tests in blood.

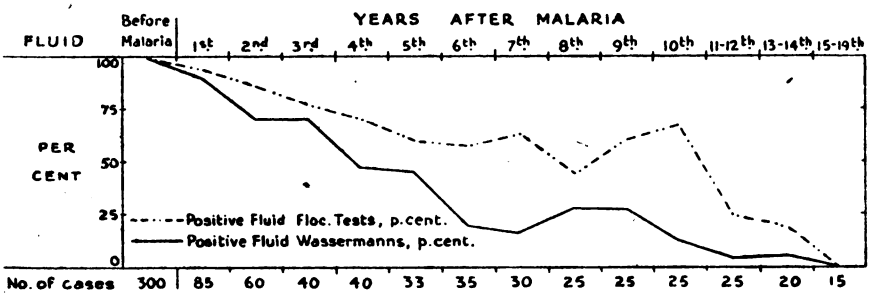

Chart 2.—Wassermann and flocculation tests in fluid.

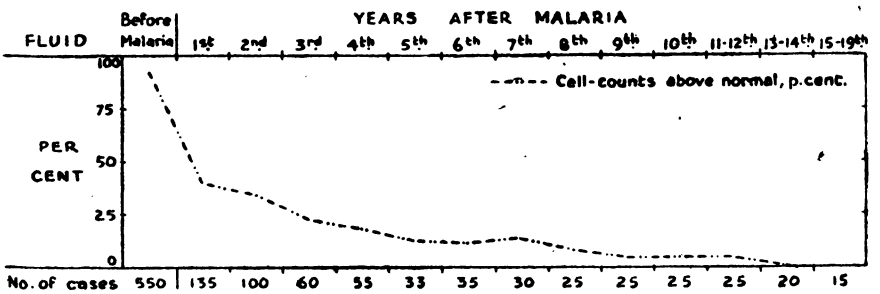

Chart 3.—Cell count.

In spite of our best cases having been discharged and therefore lost to us as regards further examinations, and even though of the 200 cases that have been re-examined after malaria only 60 were tested more than five years after malaria, no less than 49 patients gave, at some time or other after treatment, a Lange curve not reaching above a 1. The numbers of cases giving, at least once during their post-malarial career, normal results with the various fluid tests were: Wassermann, 56; flocculation tests (routine Kahn), 43; cell-count, 131; globulin test, 89; protein estimation, 102; Lange, 49. Patients giving at any time negative results with all tests on one and the same occasion numbered 32.

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The blood, of course, does not become so readily negative as the spinal fluid, but it must be mentioned that in our series we have not admitted the flocculation tests as negative unless negative results were obtained with the routine Kahn *and the Meinicke by the microscopic and centrifuge methods.* No attention was paid, however, to a positive *presumptive* Kahn, unless backed by a positive Meinicke.

The main conclusion to be drawn from the above and from Charts 1 to 5 is, therefore, that a return to normality in the spinal fluid is to be expected in a majority of cases provided sufficient time has elapsed since the malarial treatment, this normality being achieved much earlier in the case of the cell-count and the protein content than in that of the globulin test and the Wassermann, while the Kahn and the Lange are the last to cease giving the usual paretic readings.

In estimating the likelihood of serological " cures " an important factor is the choice of criteria, for unfortunately there is as yet no agreed standard in this connection. For example, E. L. Hutton (*Proc. Roy. Soc. Med.*, March, 1937, and also

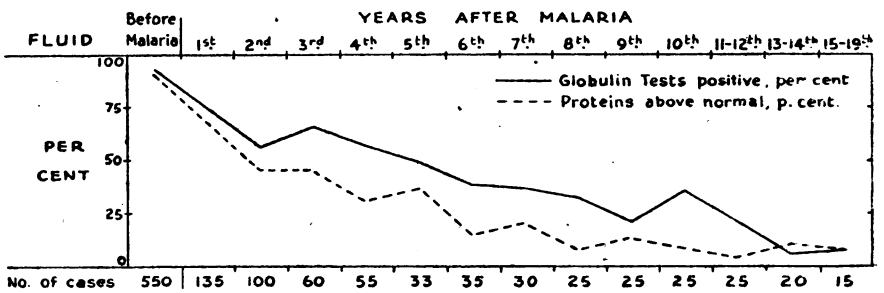

CHART 4.—Globulin and protein.

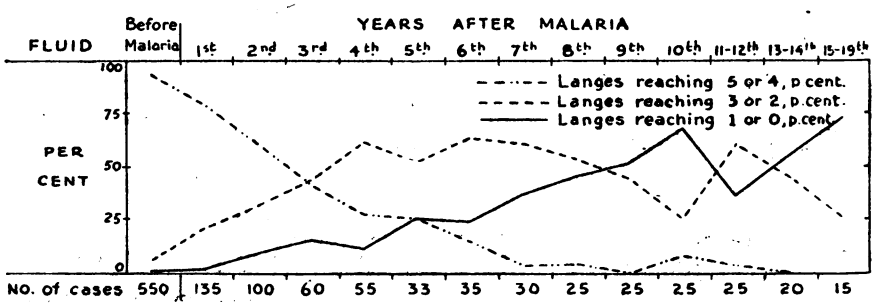

CHART 5.—Lange.

J. Ment. Sci., January, 1941) reports 80 per cent. as the proportion of such cures. Not only is this figure given without reference to the post-malarial period in which it was obtained, but it would appear that the Wassermann is taken as the chief indicator of improvement. Now if we take our fluid Wassermann results, say in the sixth and seventh post-malarial years, we too can adduce about 80 per cent. cures, but as we do not accept the Wassermann as the sole criterion and prefer to use a more efficient test in the form of the Kahn, then of course our cures become correspondingly fewer and only amount to some 40 per cent.

Some stress has been laid on this question of serological improvements as it is one that must receive due consideration in any estimation of the efficacy of malarial therapy. The need for avoiding too easy an optimism, however, is evident from the fact that serological relapses, often accompanied by clinical worsening, are by no means unknown.

LONGEVITY.

Another factor that is an important indicator in this question of assessing the results of treatment is that of length of survival. For if cases that normally, without malaria, would have had a ten to one chance of dying within a year or two of

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admission now, after malaria, live six, eight, ten or more years in good physical health, then surely the malaria must have performed its task well. Never mind the fact that the patient may not have recovered mentally; this depends largely upon whether or not the case was received early enough for treatment to be applied before irreparable brain damage had occurred. The malaria cannot do any more than deal with the infection, and it should not be expected to affect the results of structural injury.

Already in Table IV increased longevity is seen by comparing the length of residence in hospital before death of the malarial with that of the non-malarial cases. A similar comparison can be made in the case of patients still alive in hospital, while more striking still is the length of life of those who have left hospital, in so far as this can be fully ascertained.

Some of our discharges however have been lost sight of at some time or other after leaving, but rather than some of the tables having to exhibit that irritating column headed "Untraced," the longevity of these cases has been conservatively estimated by adding two years to their known span of life. For example, a patient last heard of at home in the fifth year after his original admission is assumed to have lived throughout the sixth year but to have died in the seventh.

Allowing for a few untraced cases as above, the number of malarial patients who survived five years after admission was 163 out of a total of 330 who had had the time to live the five years (i.e. who were admitted more than five years ago). The corresponding survival rate for a ten-year period is shown in Table VI, as is the rate for the 15-year group. That the survival rate in this last seems disproportionately low may in part be explained by the fact that this group is naturally composed of the cases admitted longest ago, and therefore of those who were treated in the days when drugs as adjuvants were as yet little used, the results being correspondingly the poorer. In view of the average age on admission of all cases being about 44, it is of interest to note in Table VI the average age, also *on admission*, of the survivors in the various groups.

TABLE VI.

Longevity of malarial cases.	Number of possible survivors.	Probable survivors.				
		Known to have lived.	Estimated to have lived.	Total probable survivors.	Per cent. of all cases.	Average age (on admission) of survivors.
5 years	330	160	3	163	49·4	41·7
10 ,,	250	85	1	86	34·4	41·4
15 ,,	150	28	..	28	18·7	39·1

The proportion of malarialized patients alive at home and in hospital each year after admission is shown for the 10-year series in Chart 6, in which the whole 250 cases are plotted as though they had all been admitted on the same day. Chart

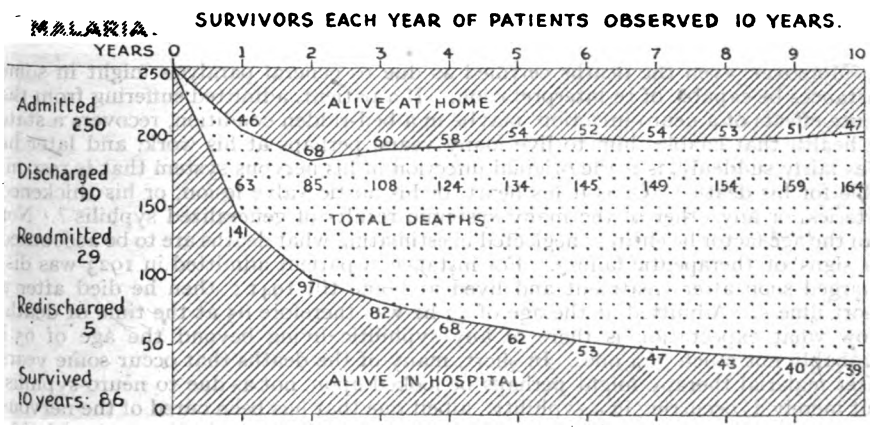

CHART 6.—Numbers alive at home and in hospital for 10 years—malaria.

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7, dealing in a similar way with 125 non-malarialized cases who might have lived ten years, shows the poor expectation of life amongst untreated patients.

Taking therefore the longevity achieved, together with serological changes and the recovery-rate, it might be said that malaria, especially if combined with drug treatments, proves itself to be effective in some 50 per cent. of cases.

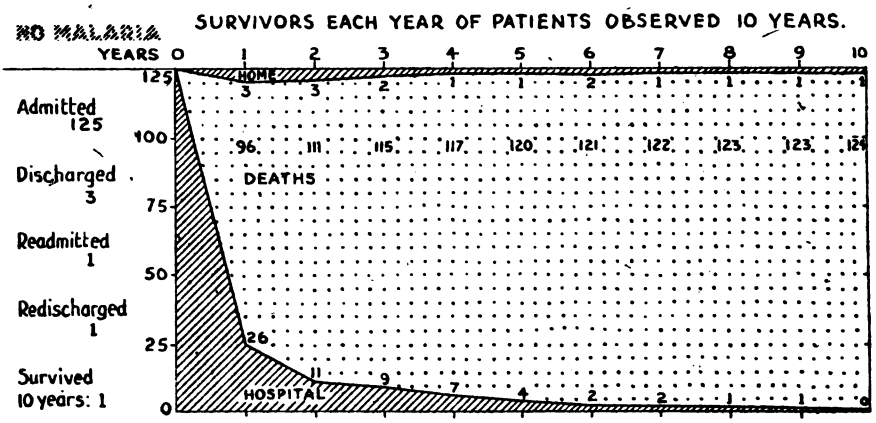

CHART 7.—Numbers alive at home and in hospital for 10 years—no malaria.

DEATHS.

Even the deaths can bear some scrutiny, for in many instances the certified cause of death was other than neuro-syphilis. Of such deaths shown in Table VII, 6 were due to accidents, 9 to tuberculosis, 15 to lobar pneumonia and influenzal broncho-pneumonia, 9 to cardio-vascular diseases and 7 to miscellaneous causes. These deaths then should be looked upon as cutting short what might otherwise have been a long post-malarial spell of freedom from the effects of neuro-syphilis.

TABLE VII.—*Deaths in Malarial Cases Due to Causes Other than Neuro-syphilis.*

Period of death after admission.	At home.	In hospital.			Total.
		Much improved.	Improved.	Not improved.	
0–5 years	5	5	8	10	28
5–10 ,,	4	1	4	3	12
Over 10 years	3	..	2	1	6
Total	12	6	14	14	46

Moreover, even the deaths certified as due to general paralysis might in some instances be capable of re-interpretation. If a patient, admitted suffering from the acute effects of a neuro-infection, maybe in a bed-ridden condition, recovers a state of health that enables him to live many years, perhaps at his work, and later he dies fairly suddenly, is it the original infection of his nervous system that is responsible for his death? Or is it his heart, or his aortic valve lesion, or his thickened arteries, or any other of the many systemic results of generalized syphilis? Nor can the age factor be entirely neglected in estimating what deaths are to be accounted as signs of therapeutic failure. For instance, a patient admitted in 1923 was discharged soon after treatment and lived at home till 1941; then he died after a short illness. Admitted at the age of 47 he was therefore 65 at the time of death. Now what expectation is there of any syphilitic living beyond the age of 65? Probably not much of a one. In short, many of the deaths that occur some years after malarial therapy might perhaps be looked upon, not as due to neuro-syphilis, but merely as occurring in a syphilitic, albeit one that has been cured of the nervous aspects of his infection. By thus taking into account those deaths that probably bear little direct relation to the neuro-syphilis, the results of malarial treatment as

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assessed in terms of discharges, longevity and improved serology might be still further enhanced.

Conclusions.

1. Malaria alone gives very fair results, but the addition of drugs leads to an improved recovery-rate.

2. While tryparsamide may be the drug of choice, results with other drugs are very comparable.

3. Resumption of malaria, even to a third attack, may give improvements that would not otherwise occur.

4. Even acute and advanced cases can make good recoveries.

5. Serological cures can be expected, though only late after malaria, the number achieved appearing lower the more are sensitive tests used in preference to less sensitive ones (e.g. the Kahn as against the Wassermann).

6. Serological changes and longevity must be added to recovery-rate in estimating the efficacy of malaria, as mental recovery alone depends upon the stage of the disease at which treatment is given.

7. The frequent clearing of the neuro-infection effected by malaria suggests that many deaths at first sight appearing as though due to general paralysis are really due to other causes, including the results of general systemic syphilis as opposed to neuro-syphilis.

8. Malaria combined with drug treatment apparently fulfils the function that can be expected of it in at least 50 per cent. of cases.

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REHABILITATION OF THE NEUROTIC.*

By Louis Minski, M.D., F.R.C.P.,
Medical Superintendent, Sutton Emergency Hospital.

In the Tomlinson report on rehabilitation the definition of this form of treatment is given in its strictly medical sense as the process of preventing or restoring the loss of muscle tone, restoring the full function of the limbs, and maintaining the patient's general health, strength, etc. This is apart from such rehabilitation treatment as is required for particular diseases such as tuberculosis. The process should begin as soon as possible after injury or operation or, in the case of acute prolonged illness, as soon as the patient's condition permits, and should continue not only throughout the period of hospital treatment, but also during the subsequent stages of convalescence, whether that takes place in hospital or is provided in a separate centre. Continuity of treatment is essential to achieve the aim of restoring the patient's mental and physical capacity at the earliest possible date, and to the fullest extent possible.

My own opinion is that rehabilitation of the neurotic must take place in the same hospital or centre at which treatment has been given in the earlier stages of the neurosis or, if such a patient is required to go for training to an outside centre, he should return to the hospital to sleep so that he can be under the supervision of those who already know his case, and where he can be free from the attendant worries of living in an outside community so soon after his neurotic illness.

The Tomlinson report also expresses the opinion that patients who have suffered from psychosis and have been discharged from a mental hospital are by no means unemployable, and that the lack of after-care is responsible for a recurrent group of readmissions. Both parts of the statement are true, but the first part gives the impression of being somewhat surprising to the compilers of the report. In my opinion it is much easier to rehabilitate a patient who has suffered from an acute or recurrent psychosis than it is to rehabilitate the neurotic. The psychotic patient suffers from a clear-cut illness which often runs a course of 3–6 months, after which he is free from symptoms, whereas the neurotic in many cases, although he has made a good adjustment while in hospital, may show residual neurotic symptoms which may tend to become more exaggerated when he is discharged from hospital and placed in a job.

At St. Ebba's Hospital, Epsom, before the war a scheme was started whereby recovered psychotic patients were trained in various and suitable trades. This was made possible by the collaboration of the L.C.C. Educational and Mental Health Services, by means of which a grant of money was made so that suitable patients could be sent to polytechnics, training centre, etc., and learn trades in which they were interested and showed some aptitude. At the time the patients attended such courses, usually in London, they lived in the hospital and travelled to them daily, while on completion of the courses, provided they were fitted to do the work, they were placed in jobs, and lived at home, if this was accessible or, if not, in suitable lodgings or a hostel. At the same time they attended an outpatient clinic in London run by St. Ebba's Hospital, where they saw the same doctor who had looked after them while they were inpatients in that hospital.

It was found by this means that many patients, who had been recurrent cases and relapsed because of the difficulty of finding employment after discharge, got on extremely well, and that relapses were prevented because of the relief from worry over unemployment with its attendant economic stresses.

I should like to discuss the rehabilitation of the neurotic both from the present

* A paper read at the Quarterly Meeting of the Royal Medico-Psychological Association held at York on May 26, 1943.

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wartime standpoint and from the post-war point of view. The wartime problem presents itself in two forms : (*a*) the service patient who returns to service duties, and (*b*) the service patient who is invalided from the service and returns to civilian life.

By far and away the majority of the service patients admitted to this hospital, apart from the small number admitted at the time of Dunkirk, and those who have experienced severe stresses of war such as torpedoing, bombardment, etc., have been the chronic neurotics of peace-time who should never have been enlisted into the services. The service patient suffering from an acute neurosis such as an anxiety state or hysterical condition at the time of Dunkirk, provided he were treated early enough, did extremely well, and after about six weeks in hospital most of them were able to return to their units. I am referring here to the patient who had a previously good personality and was good material to work on. That these cases did well may be exemplified by the case of a patient in the Guards who was admitted at the time of Dunkirk in an acute anxiety state, rapidly recovered, and a few months ago was readmitted to the surgical block of the hospital with a leg injury ,meantime having been out in Libya for many months and won the Military Medal.

Again some service patients are admitted suffering from neurosis because they are doing the wrong type of job. For instance it was not uncommon for an intelligent soldier who was trained as a lorry driver, and was known to be a good mechanic, to be doing ordinary infantry work, or an intelligent man who may have been a bank manager to be working in the Pioneer Corps. The result was that this type of patient became anxious, worried and depressed as a result of his inability to do the work because he had never been trained to do such work and often found it extremely boring, especially if he were intelligent and keen. The number of cases admitted for this reason has decreased since the Army has started selection of recruits at the time of enlistment, which gives them a course at a primary training centre lasting six weeks, where they are tested from the intellectual and vocational side, and a man is given a job commensurate with his abilities and training in civil life.

Many of these neurotics who are admitted here, however, can be posted by means of a special arrangement with the War Office to a unit where they can do the type of job which most interests and suits them ; while at the same time if it is considered that the man should be near his home, or in some rare cases, live at home, the War Office will do its best to meet these requirements.

Lastly, where a man may be fit to do a job in the army but cannot do parades, long route marches and other strenuous duties, often because of neurotic symptoms such as giddiness, palpitation, shortness of breath, etc., he can be excused from these, at the same time being given a special posting as outlined above.

Possibly you may wonder of what use such men may be in the army when such rigid prohibiting factors are placed upon their usefulness, but it must be emphasized that the main point at the present time is to conserve man-power, and if these patients can do any sort of useful job they release men more fitted for active service. These neurotic patients, for instance, if placed in units under any of the above conditions, can work in repair shops, at wireless, clerking, stores work, and other similar jobs.

So far, of several thousand such men returned to the army under these conditions, about 75 per cent. are doing their jobs quite well.

It is fairly obvious that the constitutional element in the acute war neurotic who recovers is small. In the group I have described it may be greater, and the constitutional defect becomes increasingly great in the next two groups of cases. We have first the type of man who has a good personality, negative family history and a good work record, and here the constitutional element is lacking. This man breaks down as did some men at the time of Dunkirk because of the load of physical and psychological stresses. Exhaustion, lack of sleep and food, continual retreating, inability to hit back are only some of the stresses involved. Even, however, at the time of Dunkirk, only a small proportion of our men developed neuroses, so that presumably in those who did break down there was some inherent defect which made them more liable to break down than those who did not. Going up the scale as it were one meets men with mild neurotic traits, others with more severe ones, until there is finally the chronic neurotic with a full-blown neurosis, including a

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poor personality, often positive family history, poor work record, and absence of precipitating factors.

For instance there is a type of man who is admitted to hospital because he is disgruntled, takes no interest in his work, becomes tired of rigid discipline and gets into trouble for minor offences, the patient himself describing his state as one of being " browned off." This results very often from a man joining the army full of enthusiasm, doing an intensive training, becoming a well-trained soldier, and then doing nothing more than repeat his training or go on manoeuvres without being sent on active service. In other words the man is stale and over-trained, while in other cases the state is due solely to being bored. In these cases transfer to a unit where more active service is possible or where the patient feels he is undertaking something more useful to the war effort meets the case.

Attached to this hospital is an Annexe of 200 beds for all service patients who are returning to the services, and here the patients do not go into blues but wear battle dress. They are given the heavier forms of occupation, such as engineering, carpentry, logging, wireless training, etc., while at the same time military physical training instructors give them vigorous physical training. A sergeant from the Army Educational Department organizes lectures and discussions, while an A.B.C.A. discussion group is held. Once a patient is transferred to this Annexe he knows he is due to return to the army, and the fact that all these men know this has a good effect on discipline and morale. Should a mistake be made in transferring a man to this Annexe who is later found to be unsuitable for further military service, he is not boarded from the Annexe or returned here, but is transferred to another neurosis centre. A point I should like to emphasize is the fact that none of these patients wears " hospital blues," and there is nothing to my mind more degrading for a neurotic patient than to have to wear baggy ill-fitting hospital blues, with a dirty white shirt and a frayed, washed-out tie. Many patients have often told me that they feel ashamed to walk out in the street in these blues, and I can quite well believe that they do not help to restore the patient's self-respect or remove feelings of inferiority.

The difference in the patients' bearing is surprising when they are transferred from this hospital to the Annexe and put into battle dress again, and I am quite sure that the abolition of blues for neurotic service patients would help in their recovery.

The last group of service patients I wish to mention is the chronic neurotic of peace-time. This consists of the psychopaths, hysterics, anxiety and obsessional states, often coupled with mental defect. Many of these patients belong to the social problem group who have poor work records, or belong to the chronically unemployed; while others have been able to hold their jobs down in civilian life because of indulgent employers who allow them to take time off when they are not well, or who can attend outpatient departments, or their own doctors, and are kept going by means of short psychological talks and a bottle of medicine. These patients on joining the army break down because they are unable to adapt themselves to a new set of conditions, viz. separation from their homes, communal living, discipline and unusual jobs which are sufficient to cause an exacerbation of their existing neurosis with ensuing treatment in hospital. By far and away the largest proportion of these patients have to be invalided from the service. When a service patient is to be boarded from the service a representative of the Ministry of Labour interviews all such patients in the hospital with the social worker, while the doctor has already completed a form stating what type of occupation the patient would be able to do or be fitted for. Many patients return to their previous civilian occupation, while others are sent to a Government Training Centre where they can be taught a new trade and are then placed in jobs.

Five hundred of these patients have so far been followed up, and at the end of one year 373 were working in civilian life. An analysis of this apparently large proportion of patients in work shows, however, that many of them are only being employed because of the present conditions in the labour market. Many of them are defective as well as neurotic, while a large proportion showed poor work records before enlistment and had rarely been in regular employment.

A large proportion of these patients will be thrown out of jobs as soon as demobilization begins in earnest and will again join the ranks of the unemployed. The only rehabilitation therefore which has occurred in these patients has been to

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restore them to their pre-war level of neurotic fitness, and to place them in jobs as a temporary measure owing to the extreme demand for man-power. This, however, is a point which I shall come back to later in discussing some of the post-war problems.

Industrial Side.

I should like to turn to the question of neurosis in industry. At the present time considerable numbers of civilians are doing work in factories under particularly trying conditions, having been drafted into industry without any consideration as to the type of work for which they might be fitted. The result is that quite a number of such people are unable to carry on their work because they are " square pegs in round holes," and a careful selection of those going into factories would obviously not only prevent a large amount of neurosis, but would also make for a better and quicker volume of work. In addition many such people are working extremely long hours without proper relaxation and recreation, and although they might be able to bear this strain for a certain time, eventually they do begin to crack. I have seen quite a number of such cases which might be called " exhaustion neurosis," where the patient is depressed, anxious, complaining of loss of appetite, and often has lost considerable weight. These patients usually respond to treatment quite rapidly, and often rest, a course of modified insulin and some diversional occupational therapy are all that are necessary. It is, however, useless to send these people back to industry to work under the same conditions, which are likely to result in a further breakdown, and it is necessary for them to have sufficient relaxation to avoid this. Another point which is of great importance is the fact that many of the so-called mobile workers are sent away from their homes to factories scattered round the country. They have, of necessity, to find billets, which often are uncongenial. They are often lonely, and have no recreation or relaxation to which they can return. In my opinion it is necessary to have hostels where such workers can live a communal life, and clubs where recreation will be organized so that they can profitably spend their leisure hours. Not only are these necessary in the prevention of neurosis, but also to prevent a recurrence of an illness in those who have already had one. There ought to be a better liaison between industrial welfare departments and those doctors engaged at factories and in industry, while the factory welfare worker or nurse should be made familiar with the signs of early neurosis which may herald a neurotic illness or a more severe form of breakdown.

The question of attaching psychiatrists to factories is an important one, but is probably difficult to accomplish owing to the shortage of experienced psychiatrists

Post-War Conditions.

The rehabilitation of the neurotic does not consist, as many people think, of firstly giving the appropriate psychological and physical treatment in hospital, combined with occupational therapy, and then discharging the patient, but includes the resettlement of the patient in the outside world where he can live under conditions so that he is able to lead a useful life. In the Tomlinson report it states that the only successful form of resettlement for a disabled person is employment which he can take and keep on his merits as a worker in normal competition with his fellows. It is also stated that in highly industrial countries such as Britain the number of separate occupations is so varied that it is possible to find an occupation within the physical capacity of all save a minority of the disabled. This may be applicable to the majority of the physically disabled, but for the neurotic the statement does not hold good. One knows that many patients with good personalities suffer from fairly acute neurosis, from which they make a good recovery and are able to return to the outside world, and lead normal lives comprising satisfactory employment. On the other hand a large proportion of neurotic illnesses are chronic in nature, and the result is that many of these patients are unable to work at all and belong, as I have mentioned, to the social problem group of chronically unemployed; or because of exacerbations of their illness from time to time they must enter a hospital for treatment and then attempt to return to the outside world and earn their own livings. Such patients, often because of their inability to adapt themselves to new conditions, go from job to job and rarely hold a job for any length of time, even though they are intellectually well equipped. It is well known that

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while in hospital many of the neurotics will work well under supervision in an environment where they are interested and receive the necessary sympathy, combined with discipline, and realize that their fellow men do not despise them or look upon them as being inferior because they belong to the neurotic group. This is one of the greatest difficulties which a neurotic comes up against in his life in the outside world, and no doubt is an important factor in either making him give up his job or having an exacerbation of his neurotic symptoms.

After the war, as I mentioned previously, many of the neurotics discharged from the services and now working, because of the great demand for labour, will find themselves unemployed and unable to compete with the normal people of the community. This means that they will again become a drag on the community and that they will draw the dole or obtain relief, while at the same time they must have at the back of them psychological outpatient departments and, in a number of cases, facilities for inpatient treatment from time to time.

I do not know what expenditure this involved before the war or is likely to involve after the war should such a set of conditions recur, but I do feel that it is possible to avoid such a recurrence by the setting up of neurotic colonies on the model of the Papworth Village Colony for Tuberculosis. Here I would suggest that neurotic patients live with their families under suitable conditions, that they work in the Colony and that this should be almost self-supporting, although a subsidy from the Government might be necessary. The colony would be supervised by those having psychiatric experience and who understand such cases. Perhaps you will say that by doing this one is encouraging neurotics to breed more children who themselves are potential neurotic patients, but it is obvious that such patients will refuse to live in such a colony if married unless they are able to have their families with them, and I am quite sure that as many children would be born to them outside such a colony as inside. In my view environmental factors are of much more importance in determining a neurosis than hereditary factors, and for this reason I would advocate in such colonies the setting up of child guidance clinics, where both the children and parents could attend and have, if possible, their difficulties adjusted. The schools should be run by enlightened teachers, and organized recreation, physical training and other such facilities which are likely to develop the children along more normal lines should be available. Obviously all neurotics would not be sent to such colonies, but only those who could not be adequately placed, after treatment and training, in jobs in the outside world. Although such a scheme might involve expenditure, it would be cheaper in the long run, as it ought to help to eliminate neurosis, especially if it were combined with voluntary sterilization where the disease has a marked hereditary factor.

I hope these somewhat disjointed remarks on the rehabilitation of the neurotic are not too vague and generalized. I realize that such a scheme would not be easy to achieve, but the present scheme for the rehabilitation of the neurotic is to my mind simply a temporary solution of the problem, which must be tackled with more vigour, as it will arise in a serious form after this war because of economic and other social upheavals.

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LANGUAGE AND ITS RELATION TO PERCEPTUAL AND CONCEPTUAL THOUGHT.

By E. L. HUTTON, M.B., B.S., D.P.M.,
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[Received June 6, 1943.]

SINCE psychiatry is that branch of medicine which deals with disorders of the psyche, it must inevitably include in its study the nature and activities of that which is thus disordered; it will therefore be granted that advances not only in scientific, but also in metaphysical, aesthetic and religious knowledge, must be of prime importance for the psychiatrist, since these are indubitably concerned with the activities of the psyche.

Certain modern developments in the science and philosophy of language seem to be particularly significant at the present time, and it is to some of these and their relation to modern psychological conceptions that the present chapter is devoted.

The extent of the author's indebtedness to Prof. Urban's book, *Language and Reality*, cannot be adequately acknowledged, and the book itself would well repay perusal by all who are interested in the study of the human mind.

Prof. Urban's main contention is that "mind or spirit is inseparable from language and linguistic form"; that "the limits of my language are the limits of my world" (1); and "that language is not merely the means by which truth (somehow already known without the instrument of speech) is more or less adequately expressed, but is rather the means by which the not yet known is discovered. Cognition and expression are one" (2).

It is not possible to summarize here the arguments by which Prof. Urban supports his thesis, and the criticism which he brings against those who hold contrary opinions; all that will be attempted is to consider modern developments in psychology in relation to this concept.

It is surprising how little attention has been devoted to language by psychologists, and this in spite of the fact that speech is one of the things that most clearly distinguishes man from "dumb animals." Except in slang usage the word "dumb" now means "unable to speak," but its close philological association with the German "*dumm*," meaning "stupid," suggests that our ancestors may have intuitively apprehended a relationship which we have since overlooked, perhaps because we have not fully realized that the essence of speech consists not in the mere act of speaking, but in the ability to employ sensuous engrams as mobile signs or symbols, indicating and representing something other than themselves. Helen Keller is an outstanding example of the way in which speech may be present, even when the only sense available for its activities is that of touch, so that although blind and deaf, she was neither dumb nor stupid, whereas many mental defectives, whose hearing, sight and vocal organs are unimpaired, are both.

The close relationship between language and mind has indeed been more recognized by neurologists, e.g. Pierre Marie and Henry Head, than by psychologists; for the gross disturbance of comprehension and behaviour in patients suffering from aphasia revealed the fundamental part played by speech in normal mental processes. Unfortunately the significance of this relationship has not been realized in psychology owing to the sensationalistic or mosaic and associationistic views which were so strongly held during the last century and are still extremely prevalent at the present time. The inadequacy of these hypotheses to explain mental phenomena has been demonstrated by Wertheimer and Köhler, who were thereby led to formulate the theories of Gestalt psychology. They revealed clearly that perception deals from the outset with *organized wholes*, and that these wholes are

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not identical with the sum of their parts, that far from the whole being apprehended as built up of discrete elements, the apprehension of the whole is the primary experience and that of the parts comes much later. From their work we realize that the nervous system of an animal is so constructed that it responds to some of the physical properties, *organized* in a particular way, of its environment; by virtue of this relationship between the animal and its *milieu* it is capable of detecting and selecting those components of the surrounding physical universe which are of significance to it, and the instinctive behaviour of animals shows how efficient this inherent perceptual mechanism can be. In the higher animals, however, and especially in man, although organization is still a fundamental feature of perception, the organization is not always immediately given, but may have to be constructed by the percipient himself; and in man, the principal factor in the construction of organized wholes of wider range and greater complexity, of increasing precision and subtle distinction, is language. Organized wholes are apprehended by a percipient because they are in some way significant for him, which is to say that they are intimately connected with meaning, either inherent or acquired. Wertheimer explicity recognized this when he wrote: "The processes of whole phenomena are not blind, arbitrary and devoid of meaning . . . meaningfulness obtains when the happening is determined not by blindly external factors, but by concrete inner stipulation. The mosaic or associationistic hypothesis is therefore on principle unable to supply *any* direct approach to the problem of meaning. Whether there is such a thing as meaningfulness or not is simply a question of fact" (3).

Urban shows that there are really two senses of meaning, the meaning of things and the meaning of words. In the first case "meaning" may be said to be "our *name* for cues to adaptive movement." It is more or less identifiable with motor reaction or acquired tendencies to such reaction. Urban quotes Bergson as follows: "In the animal world the meanings of things are largely instinctive, and the signs of these meanings adherent to the things signified" (4). As the result of this adhesion of the sign to the thing signified the animal is limited to the here and now, hence his dependence on immediately given stimuli and his ignorance of past and future, for though this perceptual meaning involves recognition it does not and cannot include revival of past experiences, nor can it arouse future anticipation, for these necessarily demand some degree of representation, and this is impossible unless the sign can be detached from the thing signified and can represent it in the absence of the latter.

With the introduction of language, however, signs become detachable from the things they signify, and owing to the nature of the meaning relationship the detached sign is able to *represent* that which it signifies, even when this is absent; man, therefore, unlike the animal, is no longer confined to the here and now, but by means of his language he can *represent*, i.e. bring before him, both that which is past and that which is future, that which is near and that which is far distant, and the degree to which he becomes independent of the here and now will depend upon the mobility of his signs. In order that a sign may become detached, however, it is essential that it should originally have been adherent, and it is highly probable that language is rooted in sounds having intrinsic self-authenticating expressiveness, e.g. "it is the intrinsic meaning of the sound *buzz* that turns this sound into the word *buzz*" (5). In this connection it is interesting to note that Piaget found that until the age of 5 or 6 children believe that "the name of a thing is a part of a thing. But this does not mean that it is inscribed on or materially represented in the thing. It is part of the essence of the thing. It is a characteristic of the thing, though not a psychic one, for the child does not regard the voice as immaterial, although it is invisible. During the second stage (7–8) the name becomes dissociated from the thing, but is not yet localized in the thinking subject. It is strictly speaking everywhere or rather wherever it has been spoken" (6). Between 9 and 10 names are first localized in the head, and by the age of 11 thought is regarded as immaterial. "During the first stage (5–6) children regard names as belonging to things and emanating from them. During the second stage (7–8) names were invented by the makers of things, God or the first man. In the case of the first man, the child generally supposes that the men who gave the names are those who made the things, the sun, the clouds, etc. During the third stage (9–10) the child regards names as due to men of no particular identity, while the name is

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no longer identified with the idea of creation" (6). The child at the most primitive stage of questioning "believes that in learning the names of things it is doing much more. It thinks that it is reaching to the essence of a thing and discovering a real explanation" (6).

This brings us to one of the fundamental claims made by Urban, namely, that "language itself is intuitive and part of the very perceptual process itself" (7). He writes: "What we call things are to an incalculable degree ideal constructions. Indeed things first become things to the degree in which they are objects of human activity and receive designations or names. The *namen-hunger* of the child, his passion for names, is of interest here. It is often described as a survival of the 'magic of names' of the primitive mind. What it really is, as indeed it is in primitive peoples, is the process of perceptualizing the world, the process by which sense data are transformed into things" (7). It will thus be readily understood how words are originally linked with and designate objects of sensuous perception; they are indeed used concretely, for the word and the sense data grow together in the mind to create the object which is thus designated. Later certain outstanding qualities may be abstracted from the total object, and the name originally given to the whole is now given to the quality thus abstracted; in this way language itself becomes more abstract.

In order to avoid misunderstanding it is perhaps necessary at this stage to define the meaning here given to the terms concrete and abstract. It must be recognized at the outset that these terms have no direct primary sensuous reference, there is no primary quality of objects to which we can point and say this is concrete and that is abstract, as we can say this is red, that is hard and this is hot. Concrete and abstract refer to our mode of apprehending and understanding the nature of things, it is our interpretation that varies between these modes of thought; however, we may apprehend reality we do not by one jot or tittle alter the essential nature of things. We do not by adopting a concrete or an abstract attitude make reality itself more concrete or more abstract. In accordance with the views expressed in this chapter, it is felt to be essential, in order to use the words concrete and abstract as significantly as possible, to trace them back to their origins; thus concrete is derived from *con* = together, and *crescere* = to grow, and literally designates things whose component parts "grow together," that is are found intrinsically and inseparably incorporated with one another, so that no one component can be eliminated or substituted without destroying the concrete whole of which it forms part. Concrete refers not to possible but to actual individual objects with all their properties, for example, the size, weight and appearance of a chair "grow together" as the chair is made, and are indissolubly welded together in that particular concrete whole. Abstract on the other hand, being derived from *abs* and *trahere*, literally designates things which are drawn out or taken out from something else. Thus we may *in our mind* abstract the shape of an egg from all its other qualities, such as colour, size and edibility, and we may transfer our knowledge of the shape so abstracted to other objects having no other qualities in common with the egg save this one, and speak of an oval pond or an oval mirror. Neither the egg, the pond or the mirror have become more abstract, but we, in addition to our knowledge of them as concrete wholes, have abstracted further knowledge of a quality common to them all, to which we have given the name oval; our thought has become more abstract.

The names of colours exemplify this development of abstract from concrete thought very well. Many of them are obvious, rose, violet, orange; in others the abstracting is only revealed by philology, e.g. green from O.E. *gréne*, which is cognate with grow, mauve from the Latin *malva*, mallow, the flower of that colour, and vermilion from O.F. *vermillon* (from *vermis*, worm), meaning the Kermes insect, i.e. the pregnant female of an insect, formerly taken for a berry, feeding on the Kermes oak, from the dried bodies of which a red dye stuff was extracted. This transference of names is of the very essence of language and "makes it possible to be always passing from what is known to what is yet to be known." In the first place it is essential that the relationship between the concrete whole and its abstracted part should be explicitly recognized; in order that the word green could originally be used meaningfully as a colour its association with growing must have been clearly grasped, though later when the word was in current usage as the name of a colour, its derivation could be entirely overlooked. Innumerable

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examples could be given: e.g. digit, jovial, cordial, subjugate, etc. The same applies to the metaphorical transfer of a word, the original designation of the word must be apprehended in order that the metaphorical meaning may be grasped. Richard Coeur-de-Lion is a meaningless phrase unless the primary reference to the lion is already known and understood, but if known the title abstracts and epitomizes those qualities which Richard has in common with the lion, and adds to our knowledge of Richard. The gradual movement of language effected by this transference of words is upwards, that is to say, it is from the concrete to the abstract, from the physical to the spiritual; in fact, it is only by means of this that the spiritual can become known, whence the statement that " mind or spirit is inseparable from language and linguistic form " (9) for language is the " vehicle by which the spirit comes to self-consciousness " (10).

It thus becomes understandable why behaviour based on abstract thought indicates a higher level of mental development than that which is based on a more concrete attitude. This has been recognized by many recent investigators, foremost amongst them Goldstein, Bolles, Vigotsky, Hanfmann and Kasanin.

Many tests have been designed for testing a person's ability for concrete or abstract behaviour, including the Vigotsky test, various sorting tests, Weigl's test and the Kohs' blocks. In all these the solution depends upon the abstraction of some quality or qualities from the concrete objects used in the tests. Goldstein defined the differences between abstract and concrete behaviour in the following terms: " In an abstract attitude we are not directed toward an individual object, but toward a category of which that object represents itself only as an accidental example and representative. In the concrete attitude the action is determined directly by momentary sense impressions. This concrete attitude is more realistic. We are directed rather toward the concrete thing in its particular uniqueness " (11). On the basis of this definition Goldstein and the other investigators in this sphere have found impairment of the abstract attitude in various pathological mental states, including organic cerebral lesions, dementia and schizophrenia. There is a striking unanimity concerning their findings amongst all those who are using these various tests. While not decrying the accuracy of the findings and the validity of the tests, one would however like to point out their limitations, and to criticize some of the conclusions drawn from them.

The ability to think categorically is undeniably due to abstraction, but it is not the only possible form of abstraction or of abstract thought; it is primarily a scientific mode of thought, and implies a scientific attitude to reality, which is conceived as consisting of things and their qualities which can be arranged in categories. There are, however, other modes of thought, namely, aesthetic, metaphysical and religious, each with their own particular mode of abstraction, which does not involve the use of categories. The poet makes use of abstraction when he writes:

> " Music that gentlier on the spirit lies
> Than tired eyelids upon tired eyes ";

but his intention is not to direct himself or his readers towards a category of which the experiences described represent themselves only as accidental examples and representatives, but to make use of a physical knowledge common to all tired humanity to create and to communicate understanding of something beyond mere sensuous perception, and he does it by *abstracting* from them that element which is common to the two experiences.

It is possibly true that anyone who is unable to adopt a scientific abstract attitude, i.e. is unable to classify, is also incapable of all forms of abstract thought, but this is an *a priori* assumption, and though not actually stated by those who have used the above mentioned tests, it seems to be implicit in the conclusions which they draw from their results. Because the schizophrenic, like the patient with dementia or with an organic cerebral lesion, is unable to solve these tests he is said to show a similar impairment of his abstract attitude or of his conceptual thinking (12).

When, however, one studies the paper by Hanfmann and Kasanin (13) on " Conceptual Thinking in Schizophrenia," one finds that there are differences between the schizophrenics and the other types of patients studied. When asked to group the blocks in the Vigotsky test the schizophrenic frequently showed what

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is described as physiognomic grouping. The authors describe this as follows: "In a physiognomic perception, which has often been described as typical of a primitive mentality, there is no difference between the objective qualities of the objects and the emotions they arouse. Objects appear not as large or small, with this and that colour or shape, but as powerful, weak, harmonious, threatening. Some described blocks as puny or well-behaved. One subject who described the blocks as (1) gross, crude, uncouth; (2) squat, sprawled out; (3) handsome, well proportioned, stately; (4) petite, cute, could not be made to describe these groups in terms of simple objective dimensions. Later he used the terms "dynamic" and "aesthetic" to characterize the impressions on which his grouping was made. Much more frequently the physiognomic impression was not merely stated as such, but led the subject to animate the blocks, ascribing to them character traits and other human properties, e.g. flat blocks as "sick people," "tired people,"; small tall blocks as workers, etc.; also, for example, a group of yellow blocks of different sizes "don't you think they look sick?" Subjects who ascribed human roles to blocks often tended to start a dramatic play which disrupted the task of grouping; e.g. a large block, a policeman, was once placed with a small thin blocks, with the explanation that "the policeman was whipping the workers."

Now it is one of the main contentions of Cassirer (14) that there are two different modes of apprehending reality, the mythological and the scientific. The same argument has been developed by C. Lloyd Morgan (15), who called them the scientific and the dramatic. The mythological consciousness strives to express man's intuitive apprehension of the dynamic uniformity underlying the apparent diversity of the objective world; while the scientific approach is concerned with the static multiplicity of objects and their qualities. Myth is essentially dramatic, the action and interaction of mysterious forces, and as it is derived from man's subjective awareness of the dynamic character of his own feelings and actions, it is also intensely animistic, and is the basis of our knowledge of personality. Science, on the other hand, deals only with static objects, and merely infers dynamic forces from observing differences in the appearance of these objects; it has no direct first-hand knowledge of energy processes. The former is subjective and expressionistic, the latter objective and impressionistic. These two ways, although radically different, are not antagonistic, but rather complementary and both are needed for a comprehensive knowledge of reality. Bergson (16) indeed maintained that reality is only a dynamic flux of becoming, duration, continuity, which we of necessity transform by means of our language into illusory static objects, because such objects are necessary for our manipulation; that we have direct intuition of the Heracleitian flux, but this cannot be directly expressed, and our language merely distorts reality for practical purposes. Would it not be truer to say that there are two aspects of reality, the dynamic and the static, and that scientific symbols represent the one, and dramatic and religious symbols the other?

The mythological animistic interpretation is very evident in the examples of schizophrenic sorting quoted by Hanfmann and Kasanin, where they tell how the schizophrenic subjects frequently animate the blocks, ascribing to them character traits and other human properties, and how those who ascribed human roles to the blocks often *tended to start a dramatic play* (italics mine) which disrupted the task of grouping. In a very recent paper, Goldstein (17), when discussing the behaviour of schizophrenics and patients with organic cortical lesions, asserts that "the level and kind of concreteness in schizophrenia is not identical with that in somatic cases . . . the world of the schizophrenic is much richer and more animated with personalized ideas than that of the somatic patient. That the personality change in the schizophrenic expresses itself on a different level of concreteness can be seen from another important symptom, i.e. from the aforementioned prevalence of the so-called physiognomic aspect of percepts." Johnson (18) also maintains that the schizophrenic is *extremely aware of people or of dramatic relationships towards people and that this seems to constitute one of the striking peculiarities of the disease* (italics mine). This is in marked contrast to his behaviour, where he appears asocial, aloof and reserved. Thus his hallucinations and delusions reveal the fact that the patient feels he is being watched, persecuted, influenced and controlled by other persons, and even objects tend to become personalities and to assume personal and dramatic qualities.

I would submit that the correct solution of the Vigotsky test demands the

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adoption of the scientific attitude, and that the schizophrenic patient fails because he adopts the mythological or dramatic approach; this is even recognized by one of the patients who used the term "dynamic and aesthetic" to characterize the impressions on which his grouping was made. The test therefore does not show a failure of conceptual thinking or a loss of the abstract attitude, but it does reveal an excessive preponderance of the mythological or dramatic consciousness, and an extreme reduction or absence of the scientific.

Storch (19) has discussed very fully the similarities between schizophrenic and primitive archaic or mythological thought, but he apparently considers that the mythological is merely an earlier and more primitive mode of consciousness, and that the schizophrenic patient merely shows a regression to an earlier level. Nevertheless, even Storch himself recognizes that, as shown by Otto (20), "the numinous feelings of fear aroused by the demons who live in magic, fairly tales and myths are the precursors of religious ideas." Furthermore he draws attention to certain similarities between schizophrenic and mystical experiences. Now, unless one argues that religion, mysticism and drama, are all forms of primitive archaic thought, it is obvious that the mythological and dramatic attitude to reality is itself capable of development, and that its development will consist, as in science, in the gradually increasing abstraction of its symbolic forms. In the beginning the dynamic experiences of the subject will be expressed in crudely sensuous symbols, but gradually more and more spiritual expressions will be abstracted from the physical matrix at the basis of consciousness. There are dynamic aspects of reality which can only be expressed and known by means of aesthetic and religious symbols and the distinction between the artist, the mystic and the schizophrenic, is that the former *truly* apprehend those dynamic aspects and their behaviour is ordered accordingly, while the schizophrenics' interpretation of his dynamic experiences is false, and his behaviour is correspondingly *disordered*. This statement of course assumes that reality itself is orderly.

The foregoing argument relates mainly to the role of language in conceptual thought, and especially to the dependence of the abstract attitude on the mobility of language and the transference of signs. The interdependence of language and the ability to adopt the abstract attitude has indeed been explicity recognized by Goldstein: "We know that language is more than a mere reflection of outside objects in the mind; that it is rather a means in itself for building up the world in a particular way—that is, in a categorical way" (21). "Language . . . represents a particular way of building up the world—namely, by means of abstractions" (22). Nevertheless it seems doubtful whether Goldstein has fully realized the wide implications of these statements. That language plays a considerable part in conceptual thought is generally admitted, but the statement that it is part of the perceptual process usually arouses incredulity or evokes a blank denial. Nevertheless some experiments of Bartlett lend strong support to the view. Designs of various kinds were exposed in a tachistoscope for $\frac{1}{11}$th to $\frac{1}{4}$th second and the subjects were then asked to reproduce, preferably by drawing, what they had seen, the drawings however were often supplemented by description, and if a subject had any difficulty in drawing he was simply asked to describe. Bartlett (23) found that even with very simple figures names were commonly used, and they were usually given as soon as the designs were exhibited. Whenever they were used the subject appeared more certain and satisfied; but in these simple cases the giving of a name rarely affected the accuracy of representation. With more complex designs "Naming occupied a position of greater importance. It now not only satisfied the observer, but *helped to shape his representation*" (italics mine). For example, one design was called by different observers a turf-cutter, a key, a pickaxe and an anchor, and in each case the representation was changed accordingly; the pickaxe was represented with pointed prongs, the turf-cutter with a rounded blade, and the anchor with an enlarged ring at the top. Only once was the point in the blade correctly reproduced by a subject, who called the design a "pre-historic battle-axe." With unfamiliar, odd, disconnected material, naming still played a predominant part, but in a different way, for the figure was attacked almost at once by analogy."

The Rorschach test is now very widely used as a personality test, and it has proved itself one of the most useful for giving a general comprehensive picture of the subject's character. The essence of the test is that the subject is asked to

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describe in words what he perceives in a relatively formless blot, i.e. the subject has to create meaningful forms out of the amorphous material visually presented to him; his activity is entirely unrestricted, he is merely asked to say what he sees, what the blot looks like, or suggests, or represents to him. One has only to administer the Rorschach test a few times to realize how highly individual are the percepts produced in different people by the same visual stimulus. The validity of the test lies in the fact that the subject's interpretation of the sense impressions emanating from the blot is a miniature replica of his interpretation of all visual stimuli, the percepts he creates from the blot naturally correspond with those which he creates from similar sense data in his everyday experience. It must not be forgotten, however, that the scoring of the test is based entirely on the subject's language; his actual perception is peculiar to him and cannot be communicated, his linguistic record is all that the investigator has. The part played by language in the actual perception is more clearly evident if one amplifies the original procedure by "testing for limits." After the patient has interpreted the blots one may take one or more of the blots and ask "Can you see ——", naming some specific object or event, e.g. a dog or two men carrying a basket. Quite frequently when a word or words is given like this the subject actually does perceive something which he had not perceived until that moment, thus showing he was unable himself to fuse his sense impressions with any name so as to create a meaningful percept, but when the name is supplied it actually moulds the sense-data into the corresponding percept. The investigator himself may often unintentionally have his limits tested, when a subject names an original percept, as soon as the investigator recognizes it he realizes that although he has looked at the cards time innumerable he has never "seen" this before; not only that he has not been able to incorporate it into an objective whole, but often that he has been unaware that certain particular details were even on the card, e.g. certain lines or areas of shading.

That the "Rorschach" can reveal a subject's personality to us is due to the fact that "We behold that which we are!" which was recognized long ago by Ruysbroeck, one of the great mediaeval mystics. It was also recognized by Jan Struther when she wrote:

> "Though God in seven days the world and all its ways created duly,
> Yet every man alive must, through his senses five, create it newly."

It is because every man creates his own perceptions that we may hope to assess his personality from what he sees in the blots of the Rorschach test.

It is singularly interesting that Rorschach (24), in assessing the value of the various factors concerned in forming the responses, came to the conclusion that the colour responses are indications of the extratensive and the movement responses of introversive tendencies, these latter being determined by kinaesthetic factors. This would seem to link up with the views expressed earlier in this chapter on the basic but complementary difference between the scientific and the dramatic modes of apprehension, for colour is commonly conceived as being a quality of the object seen, and is thus objective, while movement kinaesthetically determined is obviously largely subjective in character.

Rorschach publishes the following short table summarizing the differences between those in whom colour, and those in whom kinaesthesias predominate (25):

Kinaesthesias predominant.		Colour predominant.
More individualized intelligence.	.	Stereotyped intelligence.
Greater creative ability.	.	More reproductive ability.
More "inner" life.	.	More "outward" life.
Stable affective reactions.	.	Labile affective reactions.
Less adaptable to reality.	.	More adaptable to reality.
More intensive than extensive rapport.	.	More extensive than intensive rapport.
Measured, stable motility.	.	Restless, labile motility.
Awkwardness, clumsiness.	.	Skill and adroitness.

These findings are in accordance with the views expressed by Bergson and James that things are extricated for *practical* purposes from the flux of experience, and those subjects who react primarily to the dynamic kinaesthetic element in their experience are less practical and less adaptable than those who react to a quality,

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viz. colour, of external objects. Rorschach, however, stresses that these two types of reaction are complementary and not antagonistic, in fact it was in order to emphasize this that he adopted the term " extratension " instead of the more usual extraversion : " the psychological processes producing introversion and extraversion are not opposite, but different. They are as different as thinking and feeling, as motion and colour " (26). In a well-balanced personality, both movement and colour play an approximately equal part. With regard to the statements made earlier concerning schizophrenic patients, it is worth noting that Rorschach writes : " In schizophrenics the tendency to introversion is fixed so that they cannot achieve adaptation at all, or, at least, only by means of a compromise in the form of delusions " (27). This would agree with the conclusion here drawn from Hanfmann and Kasanin's results in the Vigotsky test, that in schizophrenia there is an excessive preponderance of the mythological or dramatic consciousness and an extreme reduction or absence of the scientific.

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OBSERVATIONS ON TOE-FLEXOR (SCHRIJVER-BERNHARD) AND TOE-FANNING REFLEXES IN CATATONIC SCHIZOPHRENICS.

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THE group of mental disorders classified at present under the name of " schizophrenia " or " dementia praecox " offers a number of symptoms of not entirely " psychological " nature, and a more organic line of approach to the examination of these signs.

Apart from endocrine and vegetative abnormalities, a number of cortical and subcortical disturbances have been described, such as language and speech disorders of a sensory-aphasic character and the host of so-called " psychomotor " symptoms. The best known among these are found in the catatonic group, viz. hyperkinesis, parakinesis, perseverations and reiterations (verbigeration, echopraxia and echolalia), and catalepsy. The " split " or " disorganization " of the personality manifests itself in the motor sphere by parapraxia and mannerism. A kind of " tonic innervation," such as pulling and resisting, apparently suggests " negativism." The occurrence of plastic reflexes and disturbances of the posture reflexes have been described by Delmas-Marsalet (1), Claude and his collaborators (2 and 3), and Severino (4).

Disturbances of the tonic neck reflexes have been described by Hoff and Schilder (5), hypo- or inexcitability of the labyrinth by Claude and Baruk (6). The abnormalities of the pupil reactions first noticed by Bumke are well known. Hyper- and hypo-excitability of the tendon reflexes, sluggishness of the cutaneous reflexes, positive Oppenheim and Babinski reflexes, irregularities of the Mayer and Leri reflexes have been reported (Bersot (7), Reiter (8), Runeberg (9), Sirota as quoted by Bersot, Goldstein (10), Steck (11), Livet and collaborators (12), and others). Claude, Bourguignon and Baruk (13), Last and Ström-Olsen (14), have published papers on the abnormalities of the chronaxie, and Dorsey and Travis (15) on irregularities of the reflex time.

In 1922 Schrijver (16) described a toe flexor reflex in schizophrenia. Bernhard, in 1923 (18), independently found the reflex to be positive in organic disturbances of the basal ganglia and mentions having seen it also in some catatonics. Their observations have been confirmed by Antonini (19), Bersot (7), Bielawski (see 7), Bertolini and Rieti (20), Markov (21), Severino (22).

The present investigations were initiated by some casual observations on the occurrence of toe-flexor and toe-fanning reflexes in catatonics and other schizophrenics. These phenomena have been examined and compared with the tendon reflexes of arms and legs, the Babinski, Oppenheim, Rossolimo and Mendel-Bechterew reflexes, with the Mayer and Léri reflexes and with a number of " psychomotor " symptoms, such as catalepsy, pulling and resisting. In a small number of cases other reflexes and reactions have also been examined, and the results checked on a number of normal persons under varying conditions.

The purpose of the present paper was, in the first place: (1) To study some conditions under which Schrijver-Bernhard's reflex and the fanning phenomena occur by comparison with the other clinical signs mentioned. (2) To see whether, and under what conditions, the phenomena may be obtained in normal persons. (3) To find out whether the signs are of any diagnostic value.

TECHNIQUE.

1. *Pulling.*—The examiner places his slightly bent fingers underneath the very slightly bent fingers of the patient and begins to stroke them under slight pressure.

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If the patient begins to bend his own fingers and to pull against the fingers of the examiner, the symptom is considered as positive.

2. *Resisting.*—This symptom may be demonstrated either by extending or bending the arm of the patient.

(a) *Extending.*—The forearm of the patient is bent against the upper arm with the hand bent against the forearm. The examiner begins to extend the forearm slowly, keeping the patient's hand bent against the forearm, but without exerting undue pressure.

(b) *Bending.*—With the patient's arm held straight and the fingers bent backwards, the examiner commences to bend the forearm to meet the upper arm, leaving the hand overstretched and again without undue pressure.

Growing resistance against the intended movements renders the symptom positive.

3. *Léri's reflex.*—The arm of the patient is held out, palm uppermost, and the arm slightly flexed. The examiner supports the elbow in one hand, and with the other attempts to roll up the patient's fingers and wrist as if rolling a sheet of paper. In about 90 per cent. of normal persons there is flexion of the forearm, and sometimes adduction of the upper arm is said to occur. The reflex has the same significance as Mayer's reflex.

4. *Mayer's reflex.*—The patient's hand, with the fingers slightly bent, and the thumb in slight flexion and abduction, is held in the examiner's hand, palm uppermost. The examiner then presses slowly but firmly the basal phalanx of the third and/or fourth fingers against the thenar. An adduction and extension of the patient's thumb occurs under normal circumstances.

The reflex is said to be equally present on both sides in at least 90 per cent. of normal persons. Unilaterality or weakness of the reflex on one side occurs in disturbances of the pyramidal system.

5. *The fanning phenomenon.*—This was obtained by applying the now usual technique for testing Oppenheim's reflex, which is somewhat different from that originally used by Oppenheim. Care should be taken to exert pressure only on the shin and not on the tibial muscles. A plantar flexion of the small toes is considered as a normal symptom by Oppenheim (23).

6. *The Schrijver-Bernhard reflex.*—The patient lies flat on his back with the legs stretched out and relaxed as much as possible. On tapping with the reflex hammer (or better, a large percussion hammer), either on the skin over the tibia or better on the peroneus or tibial muscles, especially below the capitulum fibulae, an extension of the small toes or no result occurs under normal conditions. The reflex is positive when a plantar flexion of the small toes occurs. Bernhard and others state that in quite a number of the organic cases the reflexogenic area extends downwards to the foot and sometimes upwards to the hip, and even further. Sometimes the reflex becomes positive on testing the ankle jerks.

As many of the toe reflexes, the Schrijver-Bernhard (S-B) and the toe-fanning reflex are dependent on the temperature, they may easily be weakened or abolished when the feet are cold. Schrijver-Bernhard's reflex is sometimes increased when the head of the patient is turned to the opposite side (in analogy to the increase of Babinski's reflex as shown by Walshe). When the reflex is doubtful it may be facilitated by applying once or several times the technique of the Oppenheim reflex before testing it, or by testing it several times. In these cases it is easily exhausted again. Active resistiveness or restlessness may prevent the occurrence of the reflex.

Case-Material and Results.

Altogether 200 cases have been included in the present study: 82 cases of schizophrenia, most of them belonging to the catatonic, hypokinetic (stuporous) group; 4 cases of epilepsy; 30 frank cases of depression and non-organic involutional melancholias; 1 case of mania; 8 cases with organic central nervous disturbances, and 75 normals.

In 11 schizophrenics, 2 epileptics, 2 depressives, and 3 organic cases among those mentioned above, an examination of the fanning phenomenon has not been carried out. None of the epileptics examined had either symptom positive, nor could they be found amongst the 31 cases of involutional depressive psychosis and acute mania.

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Schrijver-Bernhard's (S-B) reflex was found positive in 46 out of 82 schizophrenics, either isolated or together with the fanning phenomenon. The fanning phenomenon was present in 35 out of 71 schizophrenics, either isolated or together with S-B's reflex. At least one of the two phenomena investigated was found to be positive in 50 of the 71, or in 61 of 82 schizophrenics, while in 21 of these patients no such responses could be obtained.

An attempt has been made to establish the circumstances under which the reflexes appeared, especially if compared with the " psychomotor " symptoms or an increase in muscle tone, and the 8 organic cases were included for this purpose. 64 of these 90 cases showed the flexor and/or fanning signs, and in 58 of the 90 cases increased muscle tone, pulling, resisting, either isolated or in combination were present. But in only 42 of the 64 cases showing S-B and/or fanning phenomena were any psychomotor or hypertonic symptoms present, while in the other 22 reflex-positive patients no such symptoms could be obtained. On the other hand, of the 26 reflex-negative cases, 16 showed at least one " psychomotor symptom."

TABLE I.—*Comparison of Toe-fanning and Flexor Reflexes as Compared with Psychomotor Symptoms in 90 Patients.*

Psychomotor total.			Reflexes total.
58	Reflexes only	22	64
	Reflexes plus psychomotor	42	
	Psychomotor only	16	
	Nil	10	

In 50 catatonics S-B's reflex was compared with catalepsy. The former symptom was present in 27 cases, the latter in 28. In 11 of them neither symptom was present. The distribution among the remaining 39 cases was : both symptoms were found in 16 cases, catalepsy alone in 12 cases and the toe-flexor phenomenon alone in 11 cases.

TABLE II.—*Toe-flexor Reflexes as Compared with Psychomotor Symptoms in 50 Catatonics.*

Psychomotor total.			Reflexes total.
28	Reflexes only	11	27
	Reflexes plus psychomotor	16	
	Psychomotor only	12	
	Nil	11	

This shows clearly that while the reflexes will often occur together with psychomotor or other symptoms of the " hypertonic " type, they are often met with while those symptoms are absent. They are not, therefore, dependent on conditions which may be related to those of the " tonic innervation " kind.

As, however, catalepsy, pulling and resisting are usually tested on the arms, while S-B and the fanning symptom are obtained on the foot, the following examinations have been carried out on 9 stuporous catatonics.

On the arms—tone of muscles, tendon and periost reflexes, finger flexor reflexes, Mayer's reflex, Léri's reflex, pulling, resisting, catalepsy, grasping tendencies, reiterations, perseverations, parapraxia.

On the legs—concomitant movements on the toes on gripping the examiner's hand, muscle tone, tendon reflexes, Babinski's, Mendel-Bechterew's, Rossolimo's reflex, catalepsy, grasping reflex on toes, pulling, resisting.

All these signs have been compared with the S-B and fanning symptoms.

The results were similar to those mentioned above. Although in six cases most of the symptoms appeared together with S-B or fanning reflex, this was not so in three others. In a number of other cases, among them one organic with a strong S-B sign, no increase in muscle tone could be found. This confirms the above-mentioned results, that the S-B and fanning phenomena are not dependent on an increase in muscle tone or similar symptoms.

Léri's and Mayer's reflexes were examined in 46 cases, together with the other phenomena. Mayer's reflex could be obtained in all but 4 cases (3 of them were

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restless), while Léri's reflex could not be obtained in 11 of these 46 patients. An attempt to establish a possible causal correlation of the two reflexes and the psychomotor symptoms failed as before.

In the psychotic cases the toe-flexor and/or fanning phenomena were often present on one side more than on the other, or present on one side only. The distribution was as follows: In only 10 cases were the reflexes of equal strength on both sides. In 7 cases they were present on the right side only, and in another 5 cases on the right more than the left. In 10 cases they were stronger on the left side than on the right, and in 29 cases they were present on the left side only. In quite a number of cases the plantar reflex obtained by Babinski's technique was weaker on the left side also.

Controls on normal persons (50 female, 25 male), gave the following results:

S-B's reflex was definitely positive on both sides in one case, and very slightly positive in 2 subjects on the left side. Three persons showed a slight fanning sign, 2 on the right and 1 on the left side. In 1 case there was a very slight tendency towards a Rossolimo reflex on the left, and in another a doubtful Rossolimo on the right side.

Sixty-one of these normals were then asked to behave like a severe catatonic: To raise their heads from the couch, to raise one arm in a " cataleptic " attitude and to " pull " with the other and *vice-versa*. In 6 cases a slight S-B sign could be obtained (right—0, right and left—1, left—5), and in 2 cases the S-B reflex had been slightly positive before. A slight Rossolimo reflex was obtained in 12 persons (right—6, right and left—1, left—5). In 1 case there was a slight Mendel-Bechterew sign, and in 2 cases a slight irregular dorsal flexion of the hallux on Oppenheim's technique. A true Babinski reflex was never noticed. Three of the persons giving a Rossolimo reflex on the right side stated that they were ambidextrous.

As " pathological " reflexes had been obtained in normal subjects by making them behave like " catatonics " and thereby disorganizing the motor state, under which usually the examination of motor reflexes is carried out, another examination was made on 15 of these persons. All of them were right-handed. They were asked to behave in a more " intentional " way, and the foot reflexes were tested under the following conditions—strong pulling, strong pushing with the arms against the observer, moderate dorsal flexion, moderate plantar flexion of the foot, and lastly an attempt to fan the toes slightly.

The result was that the reflexes remained " normal " in 2 cases only. In 12 cases slight toe-fanning reflexes were obtained, usually with the Babinski technique, and these were equally distributed on the right and left sides. In 2 cases a slight dorsal quivering of the hallux was obtained with Oppenheim's technique. In 2 cases there was a very slight fanning tendency before provocation which became stronger afterwards. Rossolimo's reflex was obtained in 3 subjects, in all of them on the left side and obtained by pulling and pushing with the arms. The fanning signs were obtained with the same technique, although more often by intended movements of the foot. A Babinski response was never obtained.

Discussion.

Pyramidal Signs.

Contributions on the occurrence of pyramidal disturbances have been made by a number of authors who claim they have found positive Babinski or Oppenheim signs in occasional cases of schizophrenia (Bersot (7), Sirota as quoted by Bersot, Reiter (8), Runeberg (9), Steck (11) and others). Frequent disturbances of Mayer's and Léri's reflexes have been reported by Goldstein (10), Steck (11), Livet and collaborators (12).

In this series no case of true schizophrenia showed a definite Babinski sign. On testing Oppenheim's reflex a slight dorsal flexion of the hallux was noted in a small number of cases, often together with the fanning sign. The movements of the toe, however, were usually quicker and more quivering than the true Oppenheim reflex and often only an extension of the basal phalanx took place. It is therefore doubtful whether this can be evaluated as a true Oppenheim reflex and further observations will be necessary. For the time being it appears to be wiser to reconsider the diagnosis of schizophrenia in the case of a definite Babinski or Oppenheim reflex.

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Mayer's reflex could not be found in 4 out of 46 cases, and 3 of these 4 were very resistive. This observation is more in conformity with those of Stiefler (24) than with those of the other authors mentioned. Léri's reflex was found to be more irregular, but the technique and evaluation of the results of this reflex appear somewhat difficult to me. No correlations between these two reflexes and the other symptoms examined could be noticed. This is in general agreement with Steck's observations. He even concludes that the discrepancy between the different symptoms is especially great in catatonics, with the exception of a positive relation between Mayer and Léri reflexes and the tone of the muscles. Steck thinks that with hypotonia of the muscles the reflexes were often sluggish or lacking, while they were present when the tone was normal or increased. But this is in contradiction with the findings in pyramidal lesions when there is an increase in tone (spasm) and yet a disappearance of the reflexes. So the situation does not appear to be clear, and it is not intended to add to the discussion.

The Fanning Phenomenon.

The fanning phenomenon is usually considered to be of cortical pyramidal origin. Recently Fulton and his collaborators (25–29) have claimed that this reflex is a sign of a " premotor " extrapyramidal (area 6) rather than of a " precentral " pyramidal (area 4) disorder. He refers to experiments on monkeys in which the prefrontal area had been removed, and apart from spasticity and grasping reflexes, the fanning reflex, Rossolimo's and Mendel-Bechterew's toe-flexor phenomena occurred, while on removal of the precentral area, only the toe extensor reflexes and no spasticity were observed. He quotes Rossolimo and Goldflam, who, on clinical observations on man, also express the view that Rossolimo's sign is not a symptom indicating a disturbance of the pyramidal tract, but of another cortical extrapyramidal bundle. Foerster (30) differs from Fulton on the grounds of his operative and clinical experiences on man, and Walshe disagrees for other reasons (31, 32). I should like to point out :

1. After electro-shock the first pyramidal sign is a transient ankle clonus; later on, Babinski and Oppenheim reflexes can be observed in a number of cases (see also Kino and Thorpe (33)), while not one of the toe-flexor phenomena could be noticed. On the contrary, a S-B reflex present before shock is abolished by the shock and does not return until the patient nearly reaches consciousness again.

2. W. Liepmann (34) remarks that while he has often seen the appearance of the hallux dorsal flexor response in insulin shock, he has never been able to obtain one of the little toe flexor signs.

3. In the present experiments carried out on 75 normals, one of the little toe phenomena, especially fanning, Rossolimo's and Bernhard's reflex could be produced fairly often. There was never a true hallux dorsal flexor response, and in the two or three cases where a dorsal flexion could be noticed, it was more of a quick quivering kind than of the slow extension of the hallux, as observed in true pyramidal disturbance.

So it seems very likely that the conditions for the occurrence of the little toe phenomena (Rossolimo and fanning reflexes) are different from those which lead to a production of the hallux dorsal flexor response. Whether they are of pyramidal or extrapyramidal character cannot be decided at the moment. It appears justifiable, however, to assume that they are released by cortical disturbances. As regards a possible relation between the fanning phenomenon and the other symptoms examined, conditions seem to be similar to those concerning the S-B sign (see below).

Schrijver-Bernhard's Toe Flexor Reflex.

The S-B reflex is most likely not due to a lesion of the pyramidal tracts, and must not be confounded with the Mendel-Bechterew or Rossolimo reflexes (Bernhard (18), Markov (21), Bersot (7), own experience). Schrijver (17) has studied the reflex time and concludes that the reflex cannot be of cortical origin. Where the reflex has been found in organic disorders, lesions of the basal ganglia have been present or could be assumed. Seletzki (35) reports a case of a Mendel-Bechterew reflex obtained from an unusual zone. The autopsy revealed a destruction of the basal ganglia, and what he had found was most likely not the Mendel-Bechterew but the

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Schrijver-Bernhard reflex. For these and other reasons met with in organic and psychotic patients it has been assumed that the reflex indicates a disturbance of the extrapyramidal subcortical system. While this assumption appears to be correct another hypothesis has to be considered. It has been assumed by nearly all the writers concerned that the reflex is dependent on muscular hypertension in that it is often found occurring with rigidity or psychomotor symptoms.

These statements are neither borne out by facts given by other observers nor by those reported here. (1) In organic disease of the basal ganglia the reflex is very often not present, in spite of rigidity (Bernhard (18), Markov (21), Bertolini and Rieti (20), own observations). (2) The present examinations showed that although the reflex can be provoked by putting normal persons in a state of tension, and although it will often occur in catatonic schizophrenias with some form of psychomotor disturbance of the more hypertonic type, this need not necessarily be the case. These symptoms will occur without a S-B reflex, and *vice-versa*, S-B reflex was present in quite a number of cases where not the slightest form of hypertonic disorganization could be discovered. (3) The reflex is also independent of increased idio-muscular irritability and of spastic hypertension.

If one wants to say anything about the relations of the S-B symptoms to increased muscle tone, one cannot at the present moment say more than that the reflex is released by certain anatomical or functional disorganizations of subcortical " extra-pyramidal " motor function often combined with an increase in muscle tone. This may, but need not, facilitate the reflex.

The reflex is present although only rarely and very slightly in normals (Schrijver (17), Markov (21), own observations). Toe flexion is the normal response on plantar stimulation. The grasping reflex in infants is persistent much longer on the foot than on the hand (Brain and Curran (36), Sittig (37)). Sittig (as quoted by Brain and Curran) claims that under pathological conditions it is much more frequent than the grasping reflex on the hand. All this shows that the toe-flexor tendencies of the organism are very strong and so the release of such reflexes by " functionally " induced disturbances of motor regulation in normal persons may not be so strange a phenomenon as it first appears.

This is the place to say a word on the puzzling observation that the S-B and fanning reflexes were found to be preponderant on the left side (a number of patients in whom the reflex was preponderant on the right side and also some normals with a " provoked " Rossolimo stated they were ambidextrous or left-handed).

Most of the authors who have examined pyramidal or extra-pyramidal reflexes in catatonics have noted that the reflex-disturbances are very often unilateral or stronger on one side than on the other, but they do not go into details. Only Aguglia (38), referring to tendon and cutaneous reflexes, thinks that there is no side preponderance in the psychoses. Very few papers provide information in this respect. In Severino's (22) cases the S-B reflex was positive on both sides in 10, preponderant on the right side in 3 and on the left side in 2 cases. Schrijver (16) gives details of some 30 cases. Only 15 of these were apparently of a " non-organic " nature. In 3 of them the reflex was equal on both sides; a preponderance on the right side was present in 4, on the left side in 8 cases. In the present investigation the distribution of S-B and fanning sign, either isolated or together, was as follows: equal on both sides in 10 cases, preponderance on the right side in 12 and on the left side in 39 cases. If all the observations are added together the result is: out of 91 cases, the reflexes were equal on both sides in 23, preponderant on the right side in 19 cases (3 of these probably left-handed and several others possibly ambi-dextrous), and preponderant on the left side in 49 cases. Another observation may be mentioned in this connection. Last and Ström-Olsen (14) examined the chronaxie of 9 different muscle pairs in 7 schizophrenics and the estimations were repeated several times in each patient. It appears that the disturbance of the chronaxie was equal on both sides in 2 cases, it was stronger on the right in 1 case and stronger on the left side in 4 cases. As regards our findings in normal persons, there might be, after provocation, a preponderance of the S-B reflex on the left side also, while this could not be said with regard to the " pyramidal " reflexes after varying provocations. All these observations are, of course, much too small in number, and the statements of catatonics and their relatives with regard to handedness (and footedness) have to be considered with the greatest caution before drawing any conclusions. On the other hand, the observations appear to be too numerous

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to be treated without any consideration. One might think that with a pathological dis-coordination in schizophrenics, especially catatonics (and with a provoked "dis-organization" of motor regulation in normals (?), see also Jackson (39)), there is a possibility that the processes giving rise to such a disturbance, although affecting both hemispheres of the brain, will affect more the functions of the so-called "less controlled, more automatic" right hemisphere (in right-handed people). So the release on the corresponding side of the extremity of reflexes which also have a tendency to appear in normals, without, and somewhat oftener after provocation, may find a preliminary "functional" explanation.

Another possibility, perhaps in combination with that just discussed, is that in a number of "catatonic schizophrenics" the pathological process is stronger on the right side of the brain than on the left, and that some of the physical and mental symptoms met with in this disorder are due to this. The function of the right hemisphere in the production of mental symptoms is anything but clear. The problem has been discussed to some extent by neurologists. Wilson (42), Artom (43), Stern (as quoted by Artom), Sachs (44), Atkinson (45) and others are of the opinion that mental symptoms occurring in gross organic processes of the brain are of no value for the side diagnosis. Baruk's (46) material apparently confirms this. Dandy (47) and Purves Stewart (48) express the same view, although one may get another impression from the case-material published by them. Schuster (49) has reviewed 775 cases of the older literature (until 1902) with mental symptoms appearing in brain tumours. Many of his cases do not give a very detailed account of the mental symptoms. Looking through his cases one gains the impression at first that if any hemisphere is preponderant it is the left one. On closer analysis, however, it appears that the more psychotic symptoms such as confusional states, incoherence, "moria," and especially hallucinations (particularly visual), occur more often in lesions of the right hemisphere (see also the case-reports of Kanzer (50) and Moersch (51)). The occipital lobe may be an exception to this. The impression that hallucinations are produced more often when the right hemisphere is damaged is increased by a list of cases with hallucinations published by Henry (52), who surveyed a thousand cases of brain tumour, and similarly by Harrox (53).

H. Jackson calls the left hemisphere the more objective and voluntary, the right one the more automatic one. He tenders, although with some caution, the suggestion that in right-handed people "intellectual warnings" such as dreamy states preceding epileptic fits may originate in the right hemisphere (40). Such observations may be borne out by case-material published by Penfield and Ericson (54), although the authors do not comment on it. H. Jackson (41), Oppenheim, Cassirer (55–57), John (58) and others think that certain mental symptoms may be found more often if certain areas of the right hemisphere are involved. This apparently holds good at least for the symptom of so-called anosognosia (e.g. Brain (59), Rubinstein (60)), a syndrome often combined with illusions. Taking other random examples from the literature on psychoses, or mental symptoms appearing in gross neurological disorders of the brain, such as tumours, abscesses, organic epilepsy, etc., one begins to wonder whether the right hemisphere in "right-handed" people may not play a more important role in the production of some "psychotic" symptoms than is generally thought. (See references 61–81, although not all of these papers quoted confirm the view expressed here).

Differential Diagnostic Significance of the Schrijver-Bernhard and Fanning Reflexes.

From the practical differential diagnostic point of view, the two phenomena described may be of some clinical value. In considering this, one has to keep in mind, however, that reflexes can be "specific" only for the function or dysfunction of a system of the C.N.S., but not for a "disease," which will often involve different systems to a varying degree, so that the same reflex will be found in different disorders when the same system is involved. Again, reflexes which may be present only very occasionally and to a slight degree in normals, may, under certain conditions, gain a pathological significance (e.g. Chvostek's reflex in tetany).

In normals the S-B reflex is present only in a very small percentage of cases—under 10 per cent. (Schrijver (16), Markov (21), own observations). In "neurotics" it has been found by Bernhard (18) in a very few cases, while Markov (21) states that it never occurs in such disorders. In pyramidal disturbances the reflex is

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never positive. In diseases of the basal ganglia it has been found positive in 20–25 per cent. of the cases (Bernhard, Markov, Bertolini and Rieti (20)), and it has been found to be positive to about the same degree in cases of mental disorder connected with organic diseases of the brain (Markov, Bertolini and Rieti (20); some of Schrijver's cases (16)). In uncomplicated cases of epilepsy and manic-depressive insanity it was present in 7 per cent. of Bertolini and Rieti's cases, but not in those of the present author; but it may be reasonable to assume that the reflex should appear in such cases to the same small degree as it appears in normal subjects. As regards schizophrenia, it has been found to be positive especially in the catatonic type (Schrijver, Severino, Markov, Bertolini and Rieti, Bielawski as quoted by Severino). The average percentage is apparently between 40 and 50 per cent., somewhat lower in the cases of Bertolini and Rieti (35 per cent.), and somewhat higher in my own (46 out of 82).

The fanning phenomenon was present in 3 out of 75 normals, and in 35 out of 71 catatonic schizophrenics. Fanning and/or Schrijver-Bernhard's reflex were present in 61 out of 82 cases.

It can therefore be said that the S-B sign is about five to six times as frequent in catatonic schizophrenics as in other mental disorders of the so-called non-organic type, and similar figures seem to hold good with regard to the fanning symptom. The two reflexes taken together occur at least as frequently in catatonics as the usual psychomotor symptoms (catalepsy, pulling, resisting—taken together). It may be claimed therefore, that the phenomena are of some differential diagnostic value. The S-B reflex is characteristic for a certain type of subcortical extra-pyramidal disorganization, while the fanning phenomenon is apparently released by cortical disturbances.*

Summary.

1. Schrijver-Bernhard's toe-flexor and a toe-fanning phenomenon have been examined, and compared with other reflexes of the so-called "pyramidal type" and with the usual "psychomotor" symptoms occurring in catatonics. The examinations have been carried out on 75 normal persons and 82 mainly catatonic schizophrenics, the rest consisting of frank uncomplicated depressive states and a few organic psychotic and neurological cases; altogether 200 subjects have been examined. The observations of previous authors dealing with the frequency of the Schrijver-Bernhard reflex have been confirmed.

2. The toe-fanning phenomenon is probably indicative of a cortical, the Schrijver-Bernhard reflex of subcortical extrapyramidal dysfunction. Both signs occur very often together with symptoms of muscular hypertension, but they are not necessarily dependent on them.

3. It is possible under certain conditions to "provoke" toe-flexor and toe-fanning responses in normal persons.

4. The two phenomena described occur at least as frequently as the psychomotor symptoms usually found in catatonic schizophrenics, and they may therefore be of some diagnostic value.

5. The phenomena described may have a preponderance on the left side of the body. The possible significance of this has been discussed.

I wish to express my thanks to Dr. O. Fitzgerald, Acting Medical Superintendent of this Hospital, for allowing me to examine the patients of Shenley Hospital and to publish the results; to Dr. A. Stuart, who has checked my findings in quite a number of patients, but who is not to be held responsible for the views expressed in this paper; to friends of mine, and above all to the Nursing Staff of Shenley Hospital, who allowed me to carry out the experiments in the normal series, with special mention of Miss Conroy, Sister Tutor, and to Messrs. Whiffen and Pitt, without whose enthusiasm the collection of the control material would have been extremely difficult.

* *Note.*—Since this paper had gone to press two papers which might be of interest in connection with points discussed here have been published:

Saritzlli and Madonick (1943), "Statistical Control Studies in Neurology: (1) The Babinski Sign," *Arch. Neurol. and Psychiat.*, **49**, 273.

Allen and Cleckley (1943), "A New Pyramidal Sign of Great Frequency," *J. Nerv. and Ment. Dis.*, **97**, 146.

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Psychopathology: A Survey of Modern Approaches. By J. ERNEST NICOLE, L.M.S.S.A., D.P.M. London: Baillière, Tindall & Cox, 1942. 3rd edition. Pp. 265. Price 15s.

Nicole's *Psychopathology* might well be described as the British psychiatrists' Jaspers, and a third edition of this excellent survey is very welcome. The author has a real facility for presenting what is often obscure theory in the clearest possible manner, and there is little doubt that this work remains the best introduction to the subject. A large bibliography is provided, and in this edition the most important works have been marked in such a way as to guide the student in his further reading.

The general layout remains unaltered, but additions have been made to most chapters. There is also some new material in connection with cerebral anatomy, experimental work and war research. The chapter on psychoanalysis remains a clear presentation of Freud's basic findings unadulterated by that spurious product, the Klein or English school. In the reviewer's opinion psychobiology does not receive the attention it deserves. STANLEY M. COLEMAN.

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Non-Convulsive Electric (Faradic) Shock Therapy of Psychoses Associated with Alcoholism, Drug Intoxication and Syphilis.

Psyche and soma, inter-related, contribute to the "reaction of delirium" in toxic-organic psychoses. Delirious behavior is determined more by the type of personality of the individual than by the somatic changes in the brain.

Since the psychogenic psychoses showing delirious behavior appear to respond best to shock therapy, this method was employed in the treatment of acute toxic-organic psychoses. Non-convulsive electric (faradic) shock therapy, a safe, simple and inexpensive procedure, was given daily in conjunction with psychotherapy and the usual routine therapeutic measures. Thus "reaction of delirium" and the underlying organic disturbances were treated concurrently.

In 67 cases of psychoses associated with alcohol and other drug intoxications, the duration of "reaction of delirium" was definitely shortened.

In five cases of psychoses associated with syphilis of the central nervous system (general paresis), the acute delirious reactions responded favorably to this type of treatment. One patient showed complete remission. Subsequent malarial therapy given to the other four patients failed to produce further striking clinical or serological improvement.

This preliminary study indicates that in "reaction of delirium" (toxic-organic psychoses) more effective results can be obtained by administering non-convulsive electric (faradic) shock therapy in conjunction with the customary routine medical procedures. Further investigations are being made. (Author's abstr.)

Subconvulsive Electric Shock Treatment of the Psychoses.

Subconvulsive electric shock treatment by faradic current may be recommended for those patients who are disturbed, destructive, combative or otherwise difficult to manage. It has been used only in chronic cases, but the author believes if used early in the course of the disease it will aid in preventing development of these bad habits. The beneficial effects appear to be on a reality basis and due to the associated discomfort. It must not be used as punishment, and careful watch against employment of it as such is to be guarded against. It aids in eliminating restraint, reducing destruction and preventing accidents.

(Author's abstr.)

Investigation of the Effect of Inhalation of 9 per cent. Oxygen for 20 Minutes in Non-psychotic and Schizophrenic Male Subjects.

Twelve non-psychotic and 13 schizophrenic subjects were given 9 per cent. oxygen in 91 per cent. nitrogen for 20 minutes without any rebreathing of expired gases. Neurologic examinations were made at 5-minute intervals during a preliminary control period, the anoxemic period and during the recovery phase. EEG and EKG tracings were recorded and observations made of the pulse rate, respiratory rate, volume of expired air and psychological state at least once each 5 minutes.

(1) In one patient and one control subject unilateral equivocal plantar responses became definitely dorsiflexor under the administration of 9 per cent. oxygen.

2. The pupils of the schizophrenic group were smaller than those of control subjects, showed a smaller decrease in size under 9 per cent. oxygen, and had a smaller excursion in response to light when tested under anoxemic conditions.

3. Consciousness was only slightly affected in any of the 13 schizophrenic patients, but was markedly altered in 3 of the 12 control subjects. (Author's abstr.)

Psychiatric Uses of Intravenous Sodium Amytal.

1. As a sedative, sodium amytal is indicated in control of many disturbed and unco-operative patients and in *status epilepticus*.

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2. In the narcosis technique it is valuable in ameliorating catatonic excitements and in terminating manic episodes.

3. In stimulating doses it may permit accurate differential diagnosis:

(*a*) Between manic stupor and catatonic stupor.

(*b*) Between schizophrenic mutism and hysterical amnesia and aphonia.

(*c*) Cases with a good prognosis if given insulin shock therapy.

(*d*) Between organic psychosis, which requires more of the drug for stimulating or narcotic effect, and functional psychosis.

4. In stimulating doses, with or without supplemental doses of cortical stimulants (caffein, metrazol, amphetamine) it affords a means of establishing rapport with mute, resistive, retarded, aphonic, amnestic and unco-operative patients of many diagnostic types; and in activating catatonic patients so that they will eat rather than require tube-feeding.

5. In hypnotic doses it can be used to assist in inducing hypnosis in patients who do not respond to ordinary psychotherapeutic hypnosis. (Author's abstr.)

Prefrontal Lobotomy in Chronic Psychoses.

Of the 29 operated on in 1941, 6 have returned home. Four of these are adjusting socially, while 2 get along under slight supervision. A seventh has improved to such an extent that he could get along well at home provided the family was willing to accept him. Seventeen additional cases were operated on less than a month ago; it is too early to make any statement as to the outcome of these cases.

While these results are not spectacular, it must be remembered that they were formed from clay rejected by the potters. These people have passed through the hands of the private practitioner, the hospital for acute cases, and the receiving state hospital before they gravitated to the state hospital for chronic patients. Here many of them were relegated to the so-called back wards. It is fair to assume that most of them had been exposed to psychiatric study somewhere along the way. The records show that many of them had received various forms of treatment, including shock therapy. Since the majority had been hospitalized for years, spontaneous remission becomes a negligible factor. Hence we may conclude that the results are due to the operation. Therefore we consider prefrontal lobotomy a valuable method of treatment in certain chronic psychoses. (Authors' abstr.)

Symmetrical Bilateral Granular Atrophy of the Cerebral Cortex of Vascular Origin.

A case of symmetrical, bilateral granular atrophy of the cerebral cortex is described. Topographically, the atrophy is limited mainly to those areas lying at the juncture of the vascular supply of the anterior, middle and posterior cerebral arteries.

The primary involvement of the gray matter differentiates this form of atrophy from Binswanger's chronic subcortical encephalopathy. In the granular type of atrophy of the cerebral cortex those pial arteries supplying the cortex are mainly involved, while in Binswanger's encephalopathy the arteries supplying the medullary layer are primarily affected.

(Author's abstr.)

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Methods for Estimating Capacity for Recovery in Patients with Manic-Depressive and Schizophrenic Psychoses.

Methods of evaluating capacity for recovery, including conventional psychiatric procedures and determination of serum lipoids, have been investigated in 142 patients with manic-depressive and schizophrenic psychoses.

The conventional clinical psychiatric method yielded relatively dependable results in patients presenting clearcut symptoms of manic-depressive psychosis provided all patients with catatonic symptoms and other schizophrenic symptoms were excluded. Eighty-one per cent. of 90 patients so selected were doing well five to ten years after the onset of their illnesses.

In the case of the schizophrenics the results were little better than chance when patients with catatonic symptoms were included. This was also true of the patients presenting mixtures of symptoms of both syndromes.

Exclusion of patients with catatonic symptoms and queer states of excitement, however, yielded a group of schizophrenics in which 74 per cent. were showing no signs of capacity for recovery five or more years after the onset of their illnesses.

The serum lipoids, fatty acids and cholesterol were found to be associated in some way with subsequent capacity for recovery. High lipoids occurred in most patients who subsequently recovered, while low lipoids were found in those who did not.

Serum lipoid determinations, therefore, when considered in conjunction with other historical and clinical data, offer a promising supplement to methods of estimating the capacity for recovery of patients with schizophrenic and manic-depressive symptoms. (Authors' abstr.)

Comparative Electrocncephalographic Observations following Electroshock Therapy Using Raw 60 Cycle Alternating and Unidirectional Fluctuating Current.

Electroencephalographic observations have been made on 30 patients, 15 of whom received convulsions by means of raw a.c., 15 by means of unidirectional fluctuating current; and it is suggested that there is a significant increase in the occurrence of slow wave formations in that group receiving raw a.c. when compared to the group receiving unidirectional fluctuating current. Five of the 30 cases have been found to show clinical abnormalities coinciding with electroencephalographic abnormalities, and it is suggested that there is a relationship between these two phenomena. There is a possibility that cerebral dysrhythmia is more easily brought about following electroshock therapy in those patients who do not recover to the point of being well enough for discharge from a mental institution.

The above findings are submitted as a preliminary report, and the authors do not intend to infer that the series of patients observed is large enough to do more than suggest the relationships discussed in this paper. (Authors' abstr.)

The Treatment of Involutional Psychoses with Diethyl Stilbestrol.

1. Large doses of diethyl stilbestrol were administered to 45 women with involutional psychoses.

2. Twenty-seven (60 per cent.) were improved, while in a control series of 128 women only 54 (42 per cent.) were improved.

3. (*a*) The simple cases of involutional psychosis responded well to estrogenic therapy. (*b*) The cases of moderate severity and those of the mixed type reacted favorably, particularly when adjuvant therapy was employed, but relapses occurred and the degree of improvement was not as marked. (*c*) The psychotic manifestations in the severe cases were not materially affected. These cases may represent a different clinical entity than the mild cases. (*d*) Therefore, a therapeutic test with estrogenic substance may possess some diagnostic value in involutional psychoses.

4. Cases of dementia praecox, manic-depressive psychosis, and chronic psychoneurosis occurring during the involutional period were not favorably influenced by estrogenic therapy.

5. Diethyl stilbestrol administered orally was about as effective as alpha estradiol injected intramuscularly. About half of those who were given the former preparation exhibited some form of toxic reaction, which for the most part did not seriously interfere with the treatment régime. Both substances produced similar psychologic effects.

6. It is concluded that adequate estrogenic therapy has a definite value in the treatment of cases of involutional psychosis of the simple type. (Authors' abstr.)

An Alcohol Detoxication Mechanism in the Central Nervous System.

(1) An alcohol oxidation mechanism has been found to be present in brain. The extraction and analysis of the system has been described.

(2) Two members of the vitamin B complex, namely nicotinic acid and riboflavin, are components, i.e. they are essential for brain to metabolize alcohol.

(3) The possible role of the mechanism in the economy of the central nervous system has been discussed. It has been suggested that it may function as a detoxicating or protective device when alcohol is used in narcotic concentrations.

Investigations are being carried out to determine the chemical steps in the metabolism of alcohol by brain. (Author's abstr.)

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Disappointing Results with Bilateral Prefrontal Lobotomy in Chronic Schizophrenia.

Bilateral prefrontal lobotomy was performed on ten chronically disturbed schizophrenics and one mentally deficient patient. Insignificant amelioration of symptoms was noted in two and no improvement in all the other patients. One patient became decidedly worse and developed convulsive seizures two months following the operation. On the basis of their experience, therefore, frontal leucotomy is not recommended by the authors as a therapeutic procedure in chronic schizophrenia. (Authors' abstr.)

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Experimental Neuroses and Psychotherapy.

Artificially induced motivational conflicts in animals induce "experimental neuroses" characterized by anxiety reactions, persistent inhibitions, sensory hyperesthesias, phobias, compulsions and other aberrant behaviour patterns that correspond to those in human psychopathology. These neurotic manifestations are diminished or abolished by various therapeutic technics which (1) mitigate the intensity of the motivational conflict, (2) decrease the resultant anxiety, (3) force a solution by environmental pressure, (4) furnish a "social example" of more satisfactory behavior, or (5) provide the animal with manipulative means to "work through" the emotionally conflictful reality situation. These observations are consistent with certain psychobiologic principles applicable alike to comparative dynamic psychology, to semeiotic psychiatry and to clinical psychotherapeutic technics. (Author's abstr.)

Constitutional Differences between Deteriorated and Non-deteriorated Patients with Epilepsy.

1. The so-called normal, or simple hairpin-shaped, capillary loop occurs more frequently in the nail-folds of non-deteriorated subjects than in those of the mentally deteriorated ones.

2. Rudimentary or poorly developed capillary loops are found in a larger proportion of institutional patients than of non-deteriorated ones.

3. Tortuous and bizarre capillaries are significantly more frequent among deteriorated subjects than among non-deteriorated ones.

4. In the mentally deteriorated epileptic patients the incidence of capillary loops in which one limb is much more fully developed than the other is greater than in the mentally normal epileptic patients.

From these observations it is concluded that further evidence has been adduced to support the view that there are constitutional, or inborn, differences between the deteriorated and the non-deteriorated patient with epilepsy. (Authors' abstr.)

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Amyotrophic Lateral Sclerosis and Related Conditions: A Clinical Analysis.

The records of 197 patients with amyotrophic lateral sclerosis, primary lateral sclerosis or progressive muscular atrophy (various types) are analyzed and classified on the basis of their chief clinical manifestations, namely, lateral sclerosis, amyotrophy and muscular fascicular twitchings.

The cases of amyotrophic lateral sclerosis were broken down into three chief types: the Charcot, or completely developed, the atypical, and the incompletely developed. The large majority of the cases were of the first type. They were the typical cases and were characterized by well-developed amyotrophy, muscular fasciculations and pyramidal tract signs. The second, or atypical, type included the so-called monoplegic, hemiplegic, lumbar and proximal forms. Each of these terms refers primarily to the distribution of the amyotrophy, degeneration of the pyramidal tracts being essentially the same in all. In most of the cases of the atypical type the amyotrophy eventually developed in other extremities and the clinical picture became complete.

The cases of incompletely developed amyotrophic lateral sclerosis were characterized by predominance of lateral sclerosis, amyotrophy or bulbar palsy. The patients with lateral sclerosis presented rapidly developing pyramidal tract disease with urgency of urination and muscular fibrillations (but no atrophy). The patients with amyotrophy alone presented rapidly developing muscular atrophy with many muscular fibrillations, and the patients with bulbar palsy showed little besides the bulbar amyotrophy.

In cases of amyotrophic lateral sclerosis there appeared to be a close correlation of the number of muscular fibrillations and the speed of progress of the disease. It should be remembered, however, that the fibrillations may vary from time to time. Elevation of the cerebrospinal fluid proteins seemed to accompany severe amyotrophy, but did not necessarily indicate its rapid progression. Urgency of urination reflected rapid advancement of the pyramidal tract involvement.

Degeneration of the pyramidal tracts was indicated first by hyper-reflexia in the legs and later in the arms, then by a Babinski sign and, finally, by absence of abdominal reflexes. Bulbar involvement was usually indicated by amyotrophy first of the muscles supplied by the twelfth cranial nerve, then of the muscles supplied by the ninth and tenth nerves and the lower part of the seventh nerve, and, finally, of the muscles innervated by the masticator division of the fifth nerve. Pains of varying character were common and were often an early symptom, but objective sensory changes were rarely observed.

Primary lateral sclerosis and progressive muscular atrophy, both without muscular fibrillations, ran a course similar in many ways to that of amyotrophic lateral sclerosis, except that it was more slowly progressive. It is suggested that the patients with slowly progressive muscular atrophy without muscular fasciculations were suffering from an arrested or a slowly progressive type of amyotrophic lateral sclerosis, approximately 10 per cent. of the cases falling

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into this group. The reasons for and against this concept are presented, but the absence of suitable pathologic data precludes settlement of the problem at present. Data are also presented which suggest that an occasional patient with the clinical picture of amyotrophic lateral sclerosis recovers. (Authors' abstr.)

Histogenesis of the Early Lesions of Multiple Sclerosis: (1) Significance of Vascular Changes.

This study has demonstrated rather strikingly the frequent association of the early lesions of multiple sclerosis and vascular disturbances. The latter consisted of thrombosis of small veins and dilatation, engorgement and stasis of the capillaries and veins. The great majority of small lesions have been observed to be oriented about small veins. The question inevitably arises why vascular disturbances, which can be considered as of frequent occurrence in small and recent plaques, are relatively infrequent in the large and older lesions.

Two factors appear to be of importance: (1) In elongated lesions containing central veins the patches never tend to follow the entire course of the blood vessel. In the great majority of instances only one circumscribed area of the plaque is connected with the blood vessel. The foci usually envelop the central vein for a short and limited distance. As the lesion becomes larger the relation with the primary blood vessel becomes less evident. The demyelinated area tends to progress diffusely into the nerve parenchyma in different directions independent of the distribution of the primary blood vessel. It is not surprising, therefore, that in many sections from a large lesion the primary blood vessel will not be found. (2) The presence or absence of vascular changes in lesions may depend on the duration of the morbid process. Alexander and Putnam suggested that thrombi of the small veins in the older lesions of multiple sclerosis may disappear without a trace. Certainly, in older sclerotic plaques it is more difficult to trace them than in the recent lesions. (Author's abstr.)

Effect on the Electroencephalogram of Changing the Blood-sugar Level.

Electroencephalograms were recorded on 40 healthy college students, (*a*) during a routine rest period, (*b*) for 45 minutes after intravenous injection of insulin (0·05 unit per kilogram of insulin containing 40 units per cubic centimeter), (*c*) for 15 minutes thereafter after oral ingestion of 50 c.c. of Karo corn syrup and, finally, (*d*) for three minutes of voluntary hyperventilation. The blood-sugar level, the pulse rate and the blood pressure were determined systematically.

No consistent relation appeared between the electroencephalographic changes and the pulse rate or the blood pressure.

As the blood-sugar level fell (to a minimum of 53 to 85 mgm. per 100 c.c.), the normal alpha activity of the electroencephalogram was increasingly replaced by slower waves, chiefly in the 6 to 8 cycle range. The electroencephalogram returned to normal with the restoration of the blood-sugar level, but electroencephalographic changes lagged ten minutes or more behind the changes in the blood sugar.

" Slow swings " of two to five seconds' duration often appeared in the frontal record during the height of the insulin reaction. These potential changes apparently originate in the skin of the forehead.

The appearance of conspicuous electroencephalographic changes during the insulin test correlates fairly closely with the appearance of prominent slow waves during hyperventilation and with the presence of (much less prominent) slow waves in the routine electroencephalogram. Marked electroencephalographic changes during both tests were common in the mixed and the mixed slow type of electroencephalogram, less common in the regular alpha type, and rare in the low voltage and the mixed fast types.

The relative advantages of the insulin and the hyperventilation test for revealing latent electroencephalographic characteristics are considered. (Author's abstr.)

Results of Insulin and Epinephrine Tolerance Tests in Schizophrenic Patients and in Normal Subjects.

An investigation was made of the glycemic and autonomic reactions of 32 schizophrenic and 20 normal men. Forty-one per cent. of the patients showed some degree of resistance to insulin. The reactions to hypoglycemia were the same in the two groups. A lessened reactivity in blood sugar following the injection of epinephrine was noted in the patients. In general, the normal subjects showed greater changes in the blood pressure and pulse rate, paralleling the differences in the blood sugar between the two groups. (Authors' abstr.)

Cerebral Dysrhythmia in Relation to Eclampsia.

Thirteen, or 65 per cent., of 20 patients with eclampsia had electroencephalograms indicative of cerebral dysrhythmia, as compared with 2, or 10 per cent., of 20 patients with pre-eclampsia.

Twelve, or 60 per cent. of patients with eclampsia had a family and personal history of convulsive disorders, while only 2, or 10 per cent., of the pre-eclamptic patients had a similar history.

It is suggested that a primary cerebral dysrhythmia may be present in those patients having the syndrome of eclampsia, and that the associated toxemia may be the " trigger mechanism " that exaggerates the inherent dysrhythmia to the degree that convulsions appear.

A careful history, together with an electroencephalogram, might be of aid in predicting in whom eclampsia may develop.

The prophylactic therapy of eclampsia may include the use of anticonvulsant drugs.

(Authors' abstr.)

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Atypical Seizures Elicited by Electrical Stimulation of the Cerebrum in the Cat.

An unusual type of seizure following electrical stimulation of the cerebral cortex of the unanesthetized cat is described. The seizure is slow and strikingly similar to that elicited from the cerebellar cortex of the unanesthetized cat. Its mechanism is yet to be determined. It is a distinct entity, quite separate from the usual "Jacksonian seizure" also elicited from the cerebral cortex. (Authors' abstr.)

Treatment of Schizophrenia: Follow-up Results in Cases of Insulin Shock Therapy and in Control Cases.

Sixty-six patients suffering from schizophrenia were given insulin shock therapy, and the results were compared with those for a group of 132 patients treated by conservative methods. Analysis of the subsequent courses for the two groups showed similar remission rates. Insulin shock therapy by the method described does not increase the remission rate of schizophrenia over that with more conservative methods of treatment. (Authors' abstr.)

Statistical Control Studies in Neurology: (1) The Babinski Sign.

The incidence of the Babinski sign was studied in three groups of subjects: (*a*) 2,500 patients with non-neurologic conditions admitted to a general hospital; (*b*) 1,000 patients with head injuries; and (*c*) 704 inductees into the Army.

Four and three-tenths per cent. of patients in the first and second group had a positive Babinski sign.

The Babinski sign was found in 1·15 per cent. of the hospital control series, who were between the ages of 21 and 35 years, and in 1·27 per cent. of the inductees of the same age distribution.

In the hospital series the Babinski sign was nearly twice as frequent in persons over 50 as in those under 50 years of age.

Various factors which may produce a transitory Babinski sign are listed.

(Authors' abstr.)

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Experimental Studies on Headache: Analysis of the Headache Associated with Changes in Intracranial Pressure.

Headache was regularly induced in normal erect human subjects by the free drainage of approximately 20 c.c. of cerebrospinal fluid, the estimated vertex pressure falling to between —220 and 290 mm. from a normal of approximately —150 mm. Moreover, (*a*) drainage headache was reduced in intensity by the intrathecal injection of physiologic solution of sodium chloride and the restoration of the cerebrospinal fluid volume; (*b*) drainage headache was reduced in intensity by tilting the body toward the horizontal or simply by flexion or extension of the head; (*c*) in its response to postural changes drainage headache was shown to be independent of the estimated intracranial pressure; (*d*) drainage headache was usually augmented in intensity during distension of intracranial veins secondary to bilateral jugular compression; (*e*) in a subject

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who had previously had section of the roots of the fifth and ninth cranial and the upper four cervical nerves, all on one side, induced drainage headache was absent over the homolateral frontotemporal area. This indicates that the afferent impulses from the frontal portion of the area of drainage headache traverse the fifth cranial nerve.

It is thus inferred that drainage headache is caused primarily by traction by the brain on various pain-sensitive structures which anchor it to the cranium; dilatation of some of these structures, the intracranial veins, and increase in brain volume are suggested as joint factors in the augmented traction which follows drainage of fluid and leads to headache.

The headache which often follows lumbar puncture has predictable and unique features, all of which indicate its similarity to drainage headache. Like drainage headache (*a*) postpuncture headache was associated with a decrease in cerebrospinal fluid volume, as evidenced by a fall in cerebrospinal fluid pressure; (*b*) it was completely eliminated by the intrathecal injection of saline solution and by the elevation of the intracranial pressure to normal; (*c*) its intensity was reduced by change from the erect to the horizontal position or by flexion or extension of the head; and (*d*) its intensity was increased by bilateral jugular compression.

The usual variety of postpuncture headache is therefore similar in type and mechanism to the headache induced by drainage of cerebrospinal fluid; i.e. it is caused by dilatation of and traction on pain-sensitive intracranial vascular structures. It is probably secondary to a prolonged leakage of fluid through the dural hole in the lumbar sac produced by the operator's needle.

Uncommonly, postpuncture headache results from sterile "meningitis."

The headache so often associated with increased intracranial pressure has generally been assumed, but never proved, to be related to the increased pressure. Yet (*a*) elevation of intracranial pressure in normal human subjects to abnormally high levels failed to cause headache; (*b*) in a series of 72 patients with tumor of the brain, headache occurred almost as frequently with normal as with increased pressure; (*c*) headache homolateral to the lesion in a patient with a tumor of the brain was induced by lowering the intracranial pressure, but could not be induced by elevation of the pressure to a high level of 550 mm.

Hence, in the production of headache, increased intracranial pressure is neither a prime nor an essential factor.

From these data it is concluded that the headache associated with either decreased or increased intracranial pressure results from traction on or displacement of pain-sensitive intracranial structures and is independent of generalized intracranial pressure changes *per se*.

(Authors' abstr.)

Predisposing Factors in Bromide Intoxication.

Twenty-one consecutive patients admitted to the Worcester State Hospital during a five-year period with a condition diagnosed as psychosis due to bromides were studied from the point of view of underlying gross predisposing factors.

The patients belonged to an age-group ranging from 28 to 75 years, with an average of 49·5 years. There was a distinct prevalence of women in the group (15 women, 6 men).

The average level of bromides in the blood serum was 201 mgm. per 100 c.c., with a range of 60 to 400 mgm. per 100 c.c. Attention is called to the fact that this level, as well as the toxic levels given by the various authors in the literature, are in general considerably below the actual peak. The time elapsing since the cessation of bromide intake and the rate of elimination have to be considered in order to estimate the true height of the bromide level in the blood serum.

Of the mental symptoms, clouding of consciousness was found to be the most constant. Hallucinations and delusions were present in the majority of the patients. The delusional ideas referred almost invariably to some threat to the patient's life. The emotional reaction was that of fear, and occasionally that of excitement. There were no typical neurologic changes except thickened speech and ataxic phenomena. Pronounced "bromide rash" was considerably less frequent than most authors have reported.

In 17 of the 21 patients severe and etiologically significant predisposing factors were present. These were: advanced arterio-sclerosis, 5 patients; severe alcoholism, 4 patients; untreated syphilis, 1 patient; necrosis of the brain, 1 patient; physical debility (infection, dehydration), 2 patients; and involutional complications, 4 patients. The organic lesions in all patients were in a rather advanced stage. Several of these patients showed signs of a beginning organic psychosis previous to the use of bromides.

The hypothesis is advanced that there is a synergistic relationship between the phenomena referable to bromide intoxication and the underlying organic lesions.

It is concluded that in the great majority of the cases a distinct etiologic significance is to be ascribed to the pre-existing pathologic conditions. (Author's abstr.)

Attempts at Treatment of Schizophrenia and other Non-epileptic Psychoses with Dilantin.

Sixty psychotic patients, chosen as representing clear and typical instances of the more important major psychoses, were treated with dilantin in doses increased up to the point of tolerance. Improvement occurred in over half the patients during the period of treatment. It consisted usually of diminution of excitement and irritability, almost irrespective of the type of the psychosis. The patients tended to relapse when the drug was withdrawn. These results seem to justify a further study of the use of dilantin for psychotic states.

(Authors' abstr.)

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Effect of Autonomic Drugs on Cerebrospinal Fluid Pressure in Schizophrenic and Other Psychoses: (1) Effect of Histamine.

A method of studying the reactivity of the cerebrospinal fluid pressure to autonomic drugs is described. This method was employed in comparing the cerebrovascular responses of 63 schizophrenic patients and those of 68 patients with non-schizophrenic psychoses. Histamine was used in this first study because of its well-known somatic action.

Significantly smaller response of the cerebrospinal fluid pressure to subcutaneous injections of histamine was noted in the schizophrenic patients. This was associated with another observation, namely, that the schizophrenic patients tended to show less decrease of cerebrospinal fluid pressure after withdrawal of 10 c.c. of fluid.

This study indicated that schizophrenia may be characterized by a relatively limited cerebrovascular reactivity to administration of histamine. (Authors' abstr.)

APRIL.

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Grouping Behavior of Normal Persons and of Persons with Lesions of the Brain: Further Analysis.

Further analysis has been made of the grouping behavior of normal subjects and of persons with lesions of the brain from the series previously reported by one of us (W. C. H.). Groups of geometric test figures having certain characteristics in common were presented by means of a special apparatus. Both qualitative and quantitative evidences of deviation from normal performance were found in some of the experimental subjects. This evidence is in line with the earlier observations of Halstead obtained on these subjects. Various factors bearing on interpretation of the present results are discussed. (Authors' abstr.)

Calcification of the Cerebral Cortex Associated with a Meningotheliomatous Meningioma: Pathologic Study with Comment on Incomplete Types of the Neurocutaneous Syndrome.

The clinical and pathologic features of a case of Alzheimer's disease complicated by the presence of a large meningioma of the olfactory groove are presented.

The suggestion is made that the association of calcification of the cerebral cortex with the meningothelioma is part of a pathologic complex and not a mere coincidence.

The association of the Dimitri-Weber calcifications in the brain with pathologic conditions other than vascular nevi in the region of distribution of the trigeminal nerve (Sturge-Weber syndrome) is reviewed. (Authors' abstr.)

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Neurogenic Hyperthermia and its Treatment with Soluble Pentobarbital in the Monkey.

Bilateral injury to the rostral region of the hypothalamus in a series of monkeys results in an acute post-operative rise in body temperature, which if untreated proceeds to a fatal level.

This experimental hyperthermia is the result of central paralysis of the heat loss mechanism, associated with maintained or exaggerated activity of the central mechanism for heat production and heat conservation.

Intravenous administration of soluble pentobarbital (pentobarbital sodium) during the course of the hyperthermia suppresses the activity of the mechanism for heat conservation and heat production and reduces body temperature to the normal level. When administered subcutaneously, pentobarbital is relatively ineffective.

The striking efficacy of pentobarbital in reducing experimental hyperthermia in the monkey warrants its trial in the treatment of neurogenic hyperthermia following acute injury to the brain in man. (Authors' abstr.)

Treatment of Post-Lumbar-Puncture Headache with Ergotamine Tartrate.

Ergotamine tartrate was administered by the intravenous route to 8 patients. Each person received 1 c.c. of physiologic solution of sodium chloride by vein about two hours before ergotamine tartrate was administered, and in no instance was relief afforded by the injection of the saline solution. After injection of 0·25–0·50 mgm. of ergotamine tartrate by vein the patients reported beginning relief from the headache in 15 to 30 minutes. These patients were usually made to sit up each five to ten minutes, and by the end of a half-hour the headache was entirely gone or greatly diminished in intensity. This method was employed to demonstrate the precise response to intravenous administration, and it may be used in treating patients with severe headache, or as a final measure in attempting to treat that group who do not seem to respond to ergotamine tartrate.

Ergotamine tartrate, at least according to these data, is of value in relieving post-lumbar puncture headache in eight to nine-tenths of the patients only when the drug is administered according to the tolerance of the particular patient for the drug. Each person differs in this respect, and one must administer the drug as carefully as one rapidly digitalizes a patient or as one administers morphine sulfate to a patient with acute myocardial infarction. The dose for a particular patient is that amount of the drug which gives the desired therapeutic effect. Once the dose for a patient is determined it is advisable and practical to employ this quantity or to reduce it to the minimal therapeutic dose. (Author's abstr.)

Comparison of Metrazol Convulsive Therapy with Electric Shock in Treatment of Schizophrenia, Evaluation of Results Obtained in Treatment of One Hundred Schizophrenic Patients with Electric Shock.

Approximately the same results were obtained in 100 schizophrenic patients treated with electric shock as in a similar group of patients treated with metrazol. Two to eighteen months after treatment was completed, 32 patients were improved and 68 were unimproved.

There is a pronounced tendency to relapse in schizophrenic patients treated with convulsive shock therapy.

While amelioration of psychotic symptoms and behavior occurs in many patients, the essential schizophrenic pattern remains unchanged.

Convulsive shock therapy helps to achieve remissions earlier than routine institutional treatment and therefore diminishes the duration of hospitalization.

Electric shock therapy is preferable to metrazol therapy, as has been pointed out by many workers, because there are amnesia for the treatment, less fear and anxiety, painless shock and avoidance of repeated intravenous injections in resistive patients.

Its greatest value consists in aiding in the preparation of unco-operative patients for other therapeutic measures, such as psychotherapy, occupational and recreational therapy and general psychiatric management. (Author's abstr.)

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Studies of Neuro-muscular Disorders: The Myogram, Blood Cholinesterase and Effect of Prostigmine in Myasthenia Gravis and Progressive Muscular Atrophy.

(1) Myograms from patients with myasthenia gravis show a characteristic abnormality at high rates of stimulation of the motor nerve.

(2) The myogram becomes normal within 45 minutes after intramuscular injection of prostigmine, and almost at once in the injected limb when the drug is given intra-arterially. The action of prostigmine is peripheral.

(3) In a limb which has been injected intra-arterially with prostigmine the myogram remains normal after the cholinesterase of circulating blood has risen to the pre-injection level or above it. The persisting benefit in the limb must therefore be due to the lowering of muscle cholinesterase.

(4) The cholinesterase of serum and of defibrinated blood was not abnormal in patients with myasthenia gravis or progressive muscular atrophy. In each individual studied prostigmine caused a fall of serum cholinesterase which paralleled the dose. The effect of defibrinated blood was more variable.

(5) In three cases of progressive muscular atrophy fasciculation persisted in muscles after the motor nerve fibres had been blocked with novocain. The fasciculation was therefore of peripheral origin and not due to aberrant impulses from anterior horn cells. It is suggested that degeneration of the motor neurone sensitizes the muscle to normal amounts of acetylcholine, or that in some instances there may be an excess of the chemical transmitter.

(6) In patients with progressive muscular atrophy a small dose of prostigmine (0·5 to 1 c.c.) brings on or intensifies fasciculation. Normal individuals and myasthenics do not fasciculate with such doses.

(7) Mention is made of prostigmine fasciculation in animals and man. This is of peripheral origin. In animals this fasciculation disappeared after doses of curare which did not seem to affect muscle power or activity. (Authors' abstr.)

On the So-called "Laryngeal Epilepsy."

It seems reasonable to postulate a small group of cases of epilepsy in which the epileptic attack immediately follows on coughing. In this group there is usually an associated chronic laryngitis or bronchitis. In four cases, seen personally, all were of a pyknic bodily habitus. In all four cases there was no past or family record of epilepsy.

Of the aetiological theories proposed to account for laryngeal epilepsy, some may be dismissed as improbable. Thus the idea that forced expiration with the closed glottis will produce asystole and convulsions is not borne out by the four cases investigated above, and in Armstrong's (1890) case also this manoeuvre failed to produce either asystole or an attack. Weber's original observations in this connection (quoted by McBride, 1884) were made on animals and under conditions unlikely to be reproduced clinically. That cerebral venous congestion and anoxaemia due to coughing is a cause, without any other cerebral abnormality, is also unlikely; for venous constriction—with engorgement greater than that produced by violent coughing—failed to produce an attack in the man W. O—, in whom forced coughing did actually produce an aura. Moreover, in another, H. B—, in whom venous obstruction did produce an aura, the attacks occurred at times independently of coughing.

The majority of cases would appear to be primarily neurogenic—either a true reflex laryngeal epilepsy, as in W. O— or Sommerbrodt's case and in four of Charcot's, or epilepsy with a laryngeal aura as in J. L—, or finally venous congestion caused by violent coughing but in a patient with a cerebral cortex predisposed, whether by vascular degeneration or other factors, to epilepsy. (Author's abstr.)

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Current Problems in General Paralysis.

Orlando discusses the contributions to the paresis problem by depth psychology and the newer mental tests. The basic psychological characteristic is the attack on the central nucleus of the personality. The role of the organic lesion is limited to initiating a nonspecific regression to primitive levels. Paresis should be interpreted as two psychological processes: dementia, a necessary preliminary, and a latent functional psychosis precipitated by it. Their interrelationship gives the various clinical pictures. When dementia is marked, the simple form of paresis develops; when it is milder, the psychotic aspects predominate. The analytic interpretations are reviewed. The Rorschach, Babcock and Szondi tests do not demonstrate much improvement after treatment or during remissions. Mira's decortication test, specific for dementia in general, but not for paresis, is one of the most sensitive methods for demonstrating mild cortical lesions and separating the dementia from the psychosis. Studies on conditioned reflexes in paresis are promising. None of these tests are yet routine, although they are entirely practicable and are necessary for determining the quantitative aspect of remissions—a still unsolved problem, but especially important in estimating social behavior.

M. E. Morse (Psychol. Abstr.).

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Lipofuscin Distribution in the Basal Ganglia.

1. The accuracy of the view that lipofuscin of nerve cells is merely a waste product is questioned.

2. A classification of grisea based on their lipofuscin content was undertaken by Muhlmann, has already been elaborated by others to a certain extent and is applied in the present research to the so-called basal ganglia. Much emphasis is given to technic, since the various staining methods may show different chemical constituents of the pigment and thus help further in differentiating the various cell categories.

In this way a reaction is found which is characteristic of the nerve cells of the globus pallidus. The reticulate zone of the substantia nigra, the substantia innominata and the corpus subthalamicum are also characterized by the appearance and histochemical reaction of their lipofuscin. The nerve cells of the putamen, caudatum and amygdaloid nucleus show less typical reactions, except the frequently encountered peripheral arrangement of the pigment granules.

3. The lipofuscin content of neuroglia cells is very small in the basal ganglia, larger only in the reticulate zone of the substantia nigra. (Author's abstr.)

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A Quantitative and Qualitative Analysis of the Electroencephalograms of Stutterers and Non-Stutterers.

(1) A study was made to determine whether stutterers can be differentiated from normal speakers by electroencephalographic techniques. Electroencephalograms were recorded from the left occipital, motor and frontal areas of the brain from 20 stutterers and 20 normal speakers. Two records, 15 minutes long, run at least a week apart, were secured from each individual. Two 30 seconds samples were selected for quantitative measurement from each record. Measurement was made in terms of the number of waves per second. The records were also analyzed qualitatively for the presence of the abnormalities known to be related to neuropathologica activity.

(2) There were no statistically significant group differences in mean number of waves per second for any of the three areas. These results were the same for the first run records, the second run records and the two runs combined.

(3) A comparison of the mean standard deviation of the mean number of waves per second for the two groups showed no statistically significant differences for any of the three areas. These results were the same for the first run, the second run, and the combined runs.

(4) There were no significant differences in the values of correlations obtained between the two groups for first run versus second run records, or first sample versus second sample of the

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same records, indicating that stutterers were not more variable from sample to sample (ten minutes apart) and from record to record (one week apart) than the normal speakers.

(5) Qualitative abnormalities were frequent in neither group. Although three stutterers did show definite abnormalities, as opposed to only one normal speaker, 17 other stutterers did not. A much larger percentage difference would be necessary to make any conclusions meaningful. (Author's abstr.)

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A Study of Bilaterally Recorded Electroencephalograms of Adult Stutterers.

Bilateral occipital and motor area electroencephalograms were recorded from 20 stutterers and 20 non-stutterers during conditions of silence and speech. The subjects were observed during speech, and stuttering and non-stuttering were defined as temporal agreement of two judges as to whether stuttering or non-stuttering occurred. The records of each subject were examined for evidences of bilateral and unilateral blocking of the alpha rhythm. The per cent time of such blocking was computed for each subject for each of the three conditions in the experiment.

The data were then analyzed by the methods of analysis of variance and covariance in order to evaluate intergroup and intragroup differences. Variability was evaluated by computing ratios of variance in all pertinent relations.

Intergroup comparisons showed that the stutterers and the normals could not be differentiated on the basis of the mean per cent time unilateral blocking of the alpha rhythm, either in silence or in speech. There was, however, a greater bilateral blocking of the rhythm in the occipital areas in stutterers during speech than in the non-stutterers during speech.

Intragroup comparisons indicated no significant differences in the group of normals between silence and speech, but in the stutterers bilateral occipital blocking was significantly greater during speech than during silence. It may be that this intragroup increase in bilateral blocking (as well as the greater amount of bilateral blocking in stutterers than in normals during speech) may be attributed to a greater "attention" value of speech for stutterers than for normals. This hypothesis is put forth as being more acceptable than one postulating a basic physiological difference between stutterers and non-stutterers in this respect.

Interhemisphere relations indicate significant differences between stutterers and normals in the unilateral occipital alpha blocking of the two hemispheres during silence. Stutterers tended to show more blocking in the left occipital area during silence, and non-stutterers a greater amount of blocking in the right. That this interhemisphere differentiation of the two groups is lost during speech is interpreted as being in keeping with the findings of Henry that individuals with differing amounts of alpha activity during the resting state become significantly more similar when they engage in psychologically similar activities.

The interhemisphere differences in unilateral blocking during silence which distinguish the group of stutterers from the group of non-stutterers seem to point to the existence of a physiological difference between the two classes of speakers, and in so doing they invite further investigation. (Author's abstr.)

APRIL.

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*Bilateral Electroencephalograms from Normal Speakers and Stutterers. *Knoll, J. R., and Tjossen, T. D.* 357

Problem Solution by Monkeys following Bilateral Removal of the Prefrontal Areas. I. *The Discrimination and Discrimination-Reversal Problems.*

(1) Six normal monkeys and four monkeys with bilateral prefrontal lobectomies learned a series of 10 discrimination problems and 10 discrimination reversal problems.

(2) The normal monkeys learned both problems with fewer errors than the operated animals and the differences approached statistical significance. (Authors' abstr.)

Bilateral Electroencephalograms from Normal Speakers and Stutterers.

(1) Douglass has recently reported data which might be interpreted as offering support to the lateral dominance theory of stuttering.

(2) This study endeavoured to confirm the Douglass study. The procedure followed involved the addition of two new groups of stutterers to Douglass's data in order to further test his conclusion that with regard to the bilateral distribution of the alpha rhythm, stutterers form a homogeneous distribution different from that formed by normal speakers.

(3) The results indicate that when these comparisons are made, the stutterers form a homogeneous distribution with respect to differences in alpha index in the left and right occipital areas (L minus R), and that when compared with the non-stutterers, the L minus R scores are significantly lower (more positive) than those scores for non-stutterers. No such differences appeared in the data from the motor area.

(4) These findings may be tentatively evaluated in terms of Jasper's hypothesis of cortical excitatory state. Such an evaluation would lead to the conclusion that stutterers tend to have a different lateral (hemispheric) excitability than do non-stutterers; this is powerful support for that theory of stuttering based on the concept of lateral cerebral dominance.

(5) There is a difference, however, between the statistical average of stutterers (or non-stutterers) and any given stutterer (or non-stutterer). The overlap in the distribution of L minus R occipital per cent time alpha will not permit generalization to the effect that a difference in cortical excitatory state is the only etiological factor related to stuttering.

(Authors' abstr.)

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Personality Patterns in Adolescence as Portrayed by the Rorschach Ink-blot Method. I. *The Movement Factors.*

There is a detailed discussion of the interpretation and significance of movement responses in Rorschach records, relevant literature being reviewed. 76 children were given Rorschach tests at 12 and at 15 years of age; this report deals with the human and animal movement responses elicited. In Tables 1 and 3 norms for M and C patterns are presented, and Table 2 gives norms for similar ages (12 and 15) reported by other investigators. Extensive statistical analyses of the data are presented and discussed, and related to data in the literature. The results are summarized in terms of normality of distributions, norms, age differences, sex differences, variability of the groups, correlated patterns. "While children at 12 and 15 years of age exhibit many individual differences in their introversive capacities, older children are characteristically more introversive and more concerned with their inner urges and subjective experiences. Older children are more mature emotionally. Girls show these traits more than boys."

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An Exploratory Study of Personality Characteristics in Schizophrenia and Manic-depressive Psychoses.

A test was used which measured (1) things considered wrong ; (2) worries, fears, and anxieties; (3) likes and interests ; (4) kinds of people liked or admired. Data are presented for 35 schizophrenics, 35 manic-depressives, and 70 adult controls. Parts 2 and 3 elicited many more responses from the psychotics than from the controls, with greatest responsiveness among the schizophrenics. Several methods of analysis were used. Item analysis, based on two methods of determining proportional responsiveness of the groups to items, was conducted, and two lists of items which differentiated between the schizophrenics and controls and two which differentiated between the manic-depressives and the controls are presented. Various interpretative problems are raised. C. N. COFER (Psychol. Abstr.).

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Babinski Sign in Macaca mulatta.

Macaca mulatta presents a degree of cortical encephalization which is greater than had been previously suspected. The sign of Babinski can be elicited, but extensive bilateral cortical lesions are required. No specific area has been found responsible for the production of the sign.

S. M. COLEMAN.

Electrical Shock for Psychoses.

Having treated 250 cases with electrical shock the authors conclude that it is a simple, safe and effective method of inducing convulsions. They find that the complications are less than those occurring during metrazol convulsions. In their series 73 per cent. of the affective psychoses and 24 per cent. of the schizophrenic group were able to leave hospital in an average hospitalization of 45 days in the former and three months in the latter. S. M. COLEMAN.

Encephalo-Myelo-Radiculitis.

Eight cases of an unusual involvement of the nervous system are reported. The writers call this symptom-complex " Encephalo-myelo-radiculitis," since it most adequately describes the distribution of the clinical symptoms. The clinical picture may be most variable since any or all parts of the nervous system may be damaged. Certain features, however, aid in the diagnosis, namely: a cell-protein dissociation in the spinal fluid; a normal or only slightly raised temperature and leukocyte count; and a favourable prognosis with almost complete recovery in spite of the apparent severity of the illness. S. M. COLEMAN.

Cardio-vascular Collapse after Insulin.

From the case described and a few similar cases reported in the literature, it is concluded that the immediate post-hypoglycaemic state is especially prone to show acute circulatory disturbances. The intra-cardiac injection of adrenalin in acute heart failure in insulin shock has proved to be of definite value. S. M. COLEMAN.

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*A Suggested Treatment of Spinal Block Caused by Spinal Adhesive Arachnoiditis by Means of Repeated Spinal Air Injection. *McIntyre, H. D.* 668
*On the Use of Curare in Modifying Convulsive Shock. *Woolley, F., Jarvis, J. R., and Ingalls, G. S.* 680

Assault Injuries in a State Hospital.

Assault injuries at the Rockland State Hospital were analyzed for the period 1931 to 1940. Of 16,337 admissions, 287 patients made 857 assaults. Males predominated (60·3 per cent.). The greatest number of assaultive patients were paranoid schizophrenics. Epileptics were the most assaultive in proportion to their numbers, with the schizophrenics and paretics second and third. 14 patients (1·6 per cent.) died as the result of injuries. Most of these deaths resulted indirectly from other complicating factors. S. M. COLEMAN.

Neurological Complications after Pregnancy.

A case of massive encephalomalacia occurring suddenly on the tenth day of an otherwise healthy puerperium is described. The only neurological findings during the patient's subsequent 18 years of life were a right hemiplegia and a motor aphasia. The aetiology and mechanism of the cerebral damage are critically reviewed. The possible mechanism is that of air embolism, the air entering the circulatory system through patent uterine sinuses. S. M. COLEMAN.

Post-encephalitic Parkinsonism.

This study is based on observation of 27 patients, who were followed for one and a half years. It was found that large doses of a single alkaloid of the atropine group are an effective method

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of decreasing the tremor and improving the locomotion of the post-encephalitic Parkinsonian. Large doses are relatively well tolerated. Psychological factors are prominent in this disease and cannot be neglected in evaluating any medication. Unusually satisfactory adjustment to the disease is common. All the patients showed a reduction of intellectual efficiency.

S. M. COLEMAN.

Treatment of Spinal Block.

Localized adhesions of the spinal arachnoid may cause complete spinal block identical with that produced by cord tumour. The cause in the cases observed was infection of the nervous system, probably virus in origin. Laminectomy is usually advocated, yielding negative results in the author's cases.

A case is presented in which spinal air injection was effective in relieving the block produced by localized spinal adhesive arachnoiditis. The writer would suggest that his method of air injection be first used and, if this does not suffice, laminectomy should then be undertaken.

S. M. COLEMAN.

Curare in Convulsive Shock.

The writers find that curare in the form of intocostrin (Squibb) is an effective agent in preventing physical injuries to patients subjected to convulsive shock therapy either by means of metrazol or electricity. The advantages and hazards of curare medication are discussed.

S. M. COLEMAN.

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*An Analysis of the Disturbances of the Higher Cortical Functions, Agnosia, Apraxia and Aphasia. *Teitelbaum, H. A.* 44
*A Comparative Study of the Combined Metrazol-Hypoglycaemic Shock Treatment and Spontaneous Improvements in Schizophrenia. *Notkins, J.* 62

The Neurological Effects of Syphilis.

In this paper the various forms of neurosyphilis, the prognosis and treatment are reviewed. Many classifications have been offered. Anatomically neurosyphilis may be divided into syphilis of the brain and syphilis of the spinal cord. Pathologically there are meningeal or inflammatory and parenchymatous or degenerative types; in the former the changes are typical of syphilitic changes elsewhere in the body; in the latter the changes are degenerative and in no way related to the tertiary manifestations histologically. Regarding immunity and allergy, it is probable that at least two factors contribute to the development of parenchymatous neurosyphilis: first, a state of hyperallergy of neurones and neuroglia, and second, an exceedingly virulent strain of neurotropic spirochaete. It is thought that the high degree of virulence may have been attained by the spirochete in resisting antibodies.

For the therapist, a classification may be made on a combined clinical and anatomical basis, as follows: (1) More or less purely meningeal syphilis, including acute syphilitic meningitis, the neuro-recurrences and early asymptomatic neurosyphilis. (2) More or less purely vascular neurosyphilis, including localized or widespread cerebral endarteritis. (3) Diffuse meningo-vascular neurosyphilis, including brain gumma, syphilitic epilepsy, cerebrospinal syphilis and late asymptomatic neurosyphilis. (4) More or less purely parenchymatous neurosyphilis, including tabes dorsalis, dementia paralytica and primary optic atrophy. In the first three groups the inflammatory element predominates, in the last the degenerative element.

S. M. COLEMAN.

Rorschach Examinations.

The Rorschach method has been successfully applied in the diagnosis of acute psychiatric admissions. Even in mildly disturbed cases an accurate picture of the personality, as validated clinically, is obtained. The statistics obtained are comparable, in most respects, with previous studies. Studies of the kinaesthetic and colour determinants uphold the general interpretations of these factors, and substantiate the general psychiatric picture of a psychotic and neurotic personality derived by Rorschach experiments. Significant differences are found in the protocols of functional cases and organic disturbances of the C.N.S., and the signs outlined by Piotrowski are applied here with success.

S. M. COLEMAN.

Disturbances of Higher Cortical Function.

The author divides cortical function into six categories according to the degree of complexity of the integrative processes. If these functions are divided into sensory and motor, three modalities can be differentiated for each of these. In the sensory sphere, in order of increasing complexity these modalities are: (1) Primary sensation, which, if defective, gives rise to anaesthesia; (2) recognition, which, if defective, gives rise to agnosia; (3) understanding, which, if

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defective, gives rise to sensory aphasia. In the motor sphere these modalities are: (1) Voluntary contraction, disturbance giving rise to paralysis; (2) purposeful movement, disturbance giving rise to apraxia; (3) meaningful speech, disturbance giving rise to motor aphasia. The remainder of the paper is concerned with more precise definition of agnosia, apraxia and aphasia, and their causal disturbances. S. M. COLEMAN.

Metrazol-Hypoglycaemic Shock Treatment.

These writers find that the combined hypoglycaemic shock and metrazol method yield better therapeutic results (37 per cent. improved) than metrazol or insulin alone. The combined method reduces the incidence of vertebral fractures, and tends to prevent the occurrence of fractures of long bones and dislocations. Hypoglycaemic coma tends to decrease slightly the percentage of effective metrazol injections and also to decrease the convulsive threshold of metrazol. S. M. COLEMAN.

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*The Role of Hostility in Affective Psychoses. *Oltman, J. E., and Friedman, S.* . . . 170
Innervation and "Tonus" of Striated Muscle in Man. *Jacobson, E.* 197

A New Pyramidal Sign.

The leg should be entirely relaxed and the foot should be in slight plantar flexion. The second toe is flicked sharply upwards with the finger applied to the ball of the toe. After a short pause the big toe and frequently the lesser toes respond by dorsiflexion. Of 72 cases, 41 showed this sign, 20 a positive Rossolimo and only 7 a positive Babinski. It is suggested that the new sign may be a more sensitive indication of pyramidal damage than the older signs. It is admitted that the presence of the new sign in several cases of schizophrenia and in hysteria gives rise to speculation. S. M. COLEMAN.

Refrigeration Therapy in Mental Disease.

Sixteen patients with mental disease were subjected to the refrigeration treatment of Fay and Smith. Briefly the method consists in placing the patient in a suitable cabinet, where he is kept at a temperature below 85° F. up to 49 hours. The maximum number of cold treatments was 8. No mental improvement was noted. Two patients died from pneumonia and there were frequent non-fatal respiratory complications. The use of the treatment has been suspended. S. M. COLEMAN.

Hostility in Affective Psychoses.

Analytical technique has demonstrated the importance of repressed hostility, sadism, hatred and aggressivity towards the love-object in the pathogenesis of melancholia. In this paper it is shown that well crystallized evidence of hostility is also observable, or can be elicited, by ordinary psychiatric measures. It is found that during the manic phase these impulses are allowed free expression; while, in melancholia, they only escape in disguised, projected form, or are directed inwards against the ego. S. M. COLEMAN.

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The Functional Organization of the Sensory Cortex of the Cat: II.

The method of physiological neuronography, or the plotting of areas of electrocortical response resulting from local strychninization of the cortex, has been used to determine the limits and organization of the sensory cortex of the cat. Dusser de Barenne's earlier findings with respect to the extent of the sensory cortex were confirmed, but not his conclusions concerning the somatotopic organization of the sensory cortex into complete subdivisions for arm, leg, and face areas. With but one exception all electrocortical responses induced by local strychninization within the sensory area were confined to the sensory cortex; similarly stimulation outside the sensory cortex did not produce responses within the sensory area boundaries. The exception to the above occurred in the case of occipital areas 18 and 19 and frontal area 3; a reciprocal "firing" between these areas without and within the sensory cortex was demonstrated. The mediation of the discharges was via the long antero-posterior bundle connecting occipital and frontal areas. D. B. LINDSLEY (Psychol. Abstr.).

Experimental Lesions of the Pyramidal Tracts in Primates, Accompanied by a New Reflex.

A new reflex previously described by the author in human subjects and consisting of "prompt dorsiflexion of the big toe . . . when snapping the distal phalanx of the firmly grasped second toe" was tested in a chimpanzee and a monkey after experimental lesions. In the case of the former with ablations of areas 4 and 6 on the left, the new reflex (dorsiflexion of big toe) could be elicited readily on the right by snapping any of the four outer toes. The new reflex was clearly present, despite absence of Chaddock, Oppenheim, Gordon or Schaefer signs and difficulty of elicitation of the Babinski. In the case of the monkey, after the left hemisphere was removed the new reflex persisted in spite of the absence of a Babinski response. The author believes the new reflex is more easily elicited and interpreted in the case of pyramidal tract lesions than are other reflex signs, and that it may be of use in studies of representation in the motor cortex and in the evaluation of cortical dominance.

D. B. LINDSLEY (Psychol. Abstr.).

Cortical Origin and Distribution of Corpus Callosum and Anterior Commissures in the Cat: III.

After local strychninization in one hemisphere electrocortical responses were recorded in the other hemisphere of the cat's brain, before and after sectioning of the corpus callosum and anterior commissure. Sectioning of the corpus callosum abolished all responses in the contralateral hemisphere except those of area 21, and they were obliterated by section of the anterior commissure. It was found that certain areas "fire" only symmetrical points of the contralateral hemisphere; certain other areas "fire" symmetrical plus additional areas. Strynchninization of some delimited areas suppresses activity bilaterally, and the stimulation of a few areas has no detectable contralateral effect. D. B. LINDSLEY (Psychol. Abstr.).

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Cortical Response of the Anaesthetized Cat to Gross Photic and Electrical Afferent Stimulation.

1. A brief photic stimulus evokes, under several types and stages of anesthesia, one or more (multiple) cortical responses. A single electrical stimulus applied to the optic nerve does not evoke a multiple response of the type which follows photic stimulus.

2. The responses are usually predominantly surface positive, positive phase first. In light anesthesia negative components are prominent.

3. Application of 0·1 per cent. picrotoxin to the pia enhances the positive component about 25 per cent., and either initiates a large negative component or greatly enhances one already present. The positive and negative components are obviously due to separate neural processes. The positive component is associated with ascending cortical processes. The negative component is associated with descending neural processes. With picrotoxin it can be demonstrated that the negative wave is associated with activation of association areas and tectal regions. Application of nembutal to the same pial surfaces abolishes the negative wave and the projected reaction.

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4. The separateness of the positive and negative processes can also be shown by cross conditioning of the cortical mechanisms, wherein a photic stimulus applied to one eye is succeeded by an electric shock applied to the opposite optic nerve. The positive components evoked by the latter reaction are subnormal, but the negative component may be greatly facilitated.

5. Facilitation of the negative-wave-producing mechanisms may build up over a period of several hundred m.sec. This is strikingly shown by the multiple response, with or without picrotoxin. The third or fourth component of a positive multiple response may be followed by a definite negative wave. If the excitability of the negative wave mechanisms is raised by picrotoxin, or by decreasing anesthesia, the negative wave moves by steps to the first primary response.

6. Electrical shocks applied to the optic nerve evoke in the cortex three positive spikes of axon dimensions. These are followed by a slow positive wave, which in turn is typically followed by a negative wave. The amplitude of the negative wave is subject to the factors discussed above.

7. The first two spikes in the cortical record are very resistant to depression by chemicals or subnormality due to repeated activation at frequencies above 10 per second.

8. Both photic excitation of the retina and electrical excitation of the optic nerve evoke primary responses over both striate and extra-striate (or peristriate) regions.

9. The extra-striate reactions in the suprasylvian are of two types. One type is obviously due to activation of association pathways from the striate. The other exhibits characteristics of the primary projection reactions and appears to be relayed from the lateral geniculate or nuclei close to the latter.

10. It is possible to assign to particular cortical layers the components of the response to electrical stimulation of the optic nerve.

11. The predominant negativity of the photic cortical response in some cats cannot yet be adequately explained. (Authors' abstr.)

The Effect of Skeletal Fixation on Skeletal Muscle.

Skeletal fixation in rats was found to produce atrophy and hypersensitivity to intra-arterially injected acetylcholine in the involved gastrocnemius-soleus group of muscles. The atrophy was initially as marked, but did not progress as far as that seen in muscles paralyzed by the loss of their motor nerve supply. The atrophy produced was sustained for the duration of the experiment in all animals in which the fixation was maintained. (Authors' abstr.)

Intravenous Potassium, Calcium and Magnesium and the Cortical Electrogram of the Cat.

1. The cortical electrogram and the simultaneous electrocardiogram of the cat were followed continuously during the intravenous injection of salts of potassium, calcium and magnesium.

2. Potassium and calcium produced no changes in the cortical electrogram until the development of intraventricular block or of cardiac arrest. Subsequently slowing of the cortical electrogram developed.

3. Magnesium produced transient periods of slowing before pathological changes appeared in the electrocardiogram. A secondary slowing of frequency, much like that following cardiac arrest due to potassium or calcium, appeared after the development of intraventricular block.

4. Brain potentials persisted for at least fifteen minutes after complete respiratory and cardiac failure.

5. In concentrations tolerated by the intact cat, potassium and calcium are without demonstrable effect on the cortical electrogram while magnesium does have some effects.

(Authors' abstr.)

Thermo-regulatory Pathways in the Cat Brain Stem.

The brain stem pathways subserving temperature regulation in the cat have been investigated by examining the animal's regulation to a hot or cold environment, two to five weeks after producing bilateral lesions at anterior and caudal midbrain and at pontile levels.

Pathways subserving heat-loss functions appear to be concentrated in the intermediate and lateral part of the dorsal tegmentum at each of the levels studied.

Pathways subserving heat-conservation activities appear to display some concentration in the lateral as opposed to the central portion of the caudal midbrain and pons.

Following appropriately situated lesions, heat-loss activities were in some cases abolished while heat-conservation activities were maintained. This dissociation clearly indicated the existence of dual heat-regulating mechanisms, whose efferent pathways are sufficiently independent to be destroyed separately.

In the case of both heat loss and heat conservation, the component autonomic and somatic activities, sweating and facio-respiratory alteration, and piloerection and shivering, have been observed to be dissociated following appropriate lesions. Apparently these different activities are mediated by distinct anatomical connections rather than by collaterals from single pathways.

In general the results present additional evidence for the greater importance of descending tegmental as compared with descending periventricular connections in efferent conduction from the hypothalamus. (Authors' abstr.)

Spinal Distribution of Thermoregulatory Pathways in the Monkey.

In the monkey, thermoregulatory pathways for sweatings are located in the lateral and anterolateral columns of the spinal cord and exert a completely or almost completely crossed influence. The crossing is a spinal one, located close to the level of preganglionic outflow.

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Little evidence was encountered for the presence of pathways for pilo-erection and shivering in the lateral column of the spinal cord. These pathways appear to be situated in the anterior column, and are both crossed and uncrossed, the uncrossed component being the greater.
(Authors' abstr.)

The Response of Single Auditory-Nerve Fibers to Acoustic Stimulation.

The activity in single fibers of the auditory nerve in cats has been studied with the aid of micro-electrodes. The fibers were excited by delivering acoustic stimulation to the ear. Each auditory-nerve fiber responds only to a narrow band of sound frequencies when the sound intensity is just sufficient to excite it at all. Fibers were found which were specifically sensitive to narrow bands of frequencies in the frequency range between 420 c.p.s. and 25,000 c.p.s.

The auditory fiber exhibits no unusually brief refractory phenomena. It may discharge spontaneously in the absence of any apparent sound stimulus. After a period of marked activity during sound stimulation, the spontaneous activity may be temporarily depressed (silent period), then accelerated (after-discharge).

The auditory fiber typically responds to a continuous adequate sound stimulus by a train of impulses initially high, but gradually declining in rate. Within a few tenths of a second after the tone goes on this rate-adaptation is complete and the amplitude of the action potentials is somewhat diminished as well. It is concluded that auditory fibers behave in every important respect like other sensory fibers.

At constant frequency an increase in sound intensity causes an increase in rate of discharge by the single fiber. Most fibers reach a maximum of 450 discharges per second after an intensity increase of about 30 db.

The frequency band capable of exciting a given fiber increases markedly as the intensity level is raised. At levels about 100 db. above threshold tones as far away as 3 octaves below and ½ octave above may be adequate.

The auditory-nerve fiber discharges in synchronism with a definite part of the stimulating sound-wave cycle.

The results are held to support a place theory of hearing according to which pitch is a function of where, and loudness a function of how much of, the basilar membrane is disturbed.
(Authors' abstr.)

The Pseudaffective State and Decerebrate Rigidity in the Sloth.

1. Shock which follows transection of the brain in the sloth is profound for about 5 minutes, and usually disappears in 10–15 minutes.

2. Considerable activity, apparently spontaneous, is shown by sloths which have been deprived of large cortical areas, including those dominating motor reactions in higher forms.

3. A pseudo-affective state, not significantly different from that observed in higher mammals, appears following removal of the upper parts of the tardigrade cortex. This condition may persist even after brain section has been made to low levels.

4. Decerebrate rigidity in the sloth may be either flexor or extensor in type; the former is somewhat more frequent. Extensor rigidity is usually more evident during the latter part of the post-operative survival period, and is classical in type.

5. Temperature, pulse and respiratory rates were well maintained in the decerebrate sloth.
(Authors' abstr.)

MARCH.

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Investigation of Epileptiform Attacks Produced by Sudden Cooling of Frog Spinal Cord.

1. In North American frogs, *Rana pipiens*, an epileptiform attack by quick chilling of the isolated spinal cord was not produced at temperatures below 0° C.; on the contrary they have been observed in South American frogs (*Leptodactylus ocellatus*).

2. However, the attack can be obtained at 0° C. or a little below if the vertebral canal is opened and the cord directly exposed to the action of cold. In these conditions, the phenomenon, although frequent, was not constant.

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3. The attack could be induced by cooling the cord below o° C., by the application of ether, ethyl chloride, dry ice, or by utilizing freezing baths of liquids with low freezing points.

4. The characteristics of the attack depended on the method employed. When the attack was complete, it was prolonged and presented clonic and tonic phases. The feeble attacks were exclusively clonic.

5. The preliminary injection of caffeine in the frog made attacks possible up to temperatures of 3·5°.

6. In many cases the preliminary warming of the cord for several minutes at a temperature from 28 to 36° inclusive made it possible to induce an attack at o° or at least a little below o°.

7. The direct application of a concentrated solution of sodium chloride on the spinal cord produced in the North American frogs a convulsive attack perfectly resembling that observed under the same conditions in the Brazilian frogs.

8. At o° or below, *Rana catesbyana* in North America does not on chilling of the spinal cord have an attack.

9. This compared with the fact that frogs of the same species adapted to a warm climate (Cuba) for more than 20 years frequently with attacks at 1° below zero demonstrate that this convulsive reaction of the nervous system changes slowly and progressively under the action of the surrounding temperature. (Author's abstr.)

Effect of Hypothalamic Lesions on Electrical Activity of Cerebral Cortex.

A lesion limited to the hypothalamus and basal region of the brain abolishes the spontaneous electrical activity of the cerebral cortex.

After lesions of the thalamus or its thalamo-cortical pathways, the cortical activity also disappears.

On the basis of different kinds of evidence it is suggested that the hypothalamus may influence cortical activity through its thalamic connections.

Section through the midbrain does not entirely abolish cortical activity. (Author's abstr.)

Electrical Polarization of Pacemaker Neurons.

(1) The isolated heart and cardiac ganglion of *Limulus* has been used as a test of the hypothesis that the frequency of firing of nerve cell bodies depends upon the DC electrical field in which they lie.

(2) It is shown that a direct current passed through the intact heart results in an abrupt, sustained, reversible increase in frequency of heart beat and in changes in wave form of the electrogram.

(3) The effect apparently is exerted locally, at the point of contact of the electrodes and the tissue, where the current density is highest. It is usually confined to the cathode in preparations of the intact heart. The anode and the gross orientation of the field appear to be uncritical. In preparations of the isolated or partially isolated ganglion the cathode was not consistently more effective.

(4) The effect has been obtained only in the direction of an increase in the normal frequency. A possible explanation of this is offered.

(5) It is concluded from the abrupt non-adapting, non-accumulating and promptly reversible character of the effect that it is a direct effect of the DC field.

(6) The site of action is apparently the ganglion, more specifically the region of the pacemaking cell bodies. (Authors' abstr.)

Specific Excitability of the Endplate Region in Normal and Denervated Muscle.

Properties of the endplate and endplate-free regions were investigated in single nerve-muscle fiber preparation of the M. adductor longus and in isolated sartorius muscles of Australian frogs (*Hyla aurea*).

(1) Acetylcholine, nicotine and caffeine set up impulses by depolarizing the muscle membrane at the endplate region. None of the drugs appreciably depolarizes endplate free parts of muscle, or sets up impulses there.

(2) Potassium initiates impulses at the endplate region only, but no striking difference could be detected between the depolarizing action at or off the endplate.

(3) Curarine opposes the depolarization and excitation caused by the drugs, except potassium.

(4) The sensitivity at the endplates to acetylcholine, nicotine and caffeine in chronically denervated muscles (3–11 weeks) is increased from 1,000 to 100,000 times and is diminished by curarine. The selective depolarization of the endplate region and the lack of depolarization at the endplate-free regions pertains also to denervated muscle.

(5) No appreciable potential differences are found in normal uninjured muscle along the outside of isolated fibres. No evidence was obtained of potential gradients around the neuromuscular junction. (Author's abstr.)

Reflex Action in Relation to Pattern and Peripheral Source of Afferent Stimulation.

Two-neuron-arc reflex discharges in the dorsal root-ventral root reflex are secured by stimulation of the lowest threshold fibers of the dorsal root. Stimulation of the higher threshold fibers is primarily responsible for the multineuron-arc reflex discharges.

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The fibers mediating direct excitation and direct inhibition to the motoneurons are functionally indistinguishable in the dorsal root.

Afferent fibers of the size range having direct connection with the motoneurons are found in significant numbers only in muscle nerves. The group of afferent fibers which accounts heavily for connections to interneurons is prominent in cutaneous nerves, but poorly represented among the muscle afferent fibers (2–5, 10, 13). Utilizing this information it is possible to effect a high degree of separation of the two-neuron-arc and multineuron-arc reflex discharges by employing a muscle nerve and a cutaneous nerve respectively for afferent stimulation.

(Author's abstr.)

Functional Organization of Temporal Lobe of Monkey (Macaca mulatta) and Chimpanzee (Pan satyrus).

The temporal lobes of macaque and chimpanzee show the same functional organization. The lobe may be divided into two sectors: (1) An acoustic sector, consisting of the primary acoustic or auditosensory area 41, a small area 42 surrounding it, and area 22, mutually spiking each other, and (2) a temporal sector, comprising areas 21, 20 and 38, each of which fires only locally. In the primary acoustic area of the chimpanzee tones of low frequency arrive in its antero-lateral part, tones of high frequency in its postero-medial part. Within the temporal sector the existence of a temporopolar area has been demonstrated in the macaque. Commissural connections between the two temporal sectors are restricted to area 21, and take their course probably through the anterior commissure. (Authors' abstr.)

Long Association Fibers in Cerebral Hemispheres of Monkey and Chimpanzee.

By applying strychnine locally to the cerebral cortex of the monkey and chimpanzee, and recording the electrical activity, the origin and termination of homologues of three of the well-defined long association bundles of the human cerebral cortex have been disclosed. From area 8, the frontal suppressor area, there arises a tract leading to area 18, the parastriate area; this is probably part of the superior longitudinal fasciculus of Burdach. From area 18 there arises a tract leading to area 20, on the inferior temporal convolution; it is usually called the fasciculus longitudinalis inferior, and may comprise also what anatomically has been called the vertical occipital fasciculus of Wernicke. There is a tract arising from the area orbitalis granularis (called area 47 in the human brain) passing to the tip of the temporal lobe (called area 38 in the human brain); it is ordinarily called the fasciculus uncinatus. Each of these pathways normally conducts in one direction only. (Authors' abstr.)

The Effect of Oyxgen Tension on the Metabolism of Cerebral Cortex, Medulla and Spinal Cord.

The rates of oxygen uptake of cortex, medulla and spinal cord were in the ratio 100 : 34 : 12, whereas the ratio for anaerobic lactic acid production was 100 : 17 : 5.

The oxygen uptake of all three tissues was sensitive to oxygen tension. The shape of the oxygen uptake-oxygen tension curve was essentially the same for the three tissues.

The anerobic lactic acid production was twice as great in cortex as in medulla per unit of oxygen uptake in oxygen. Lactic acid production was sensitive to oxygen tension in cortex and medulla but not in cord. These differences in lactic acid production are offered in partial explanation for the variations in resistance to anoxia from one region to another within the central nervous system.

In cortex, lactic acid production and oxygen uptake varied inversely when the oxygen tension was altered.

In medulla, surprisingly enough, lactic acid production was maximal at 2 to 3 volumes per cent. oxygen. The possible relationship of this to a previously described respiratory phenomenon was mentioned. (Authors' abstr.)

The Interaction of Antidromic and Orthodromic Volleys in a Segmental Spinal Motor Nucleus.

A maximal antidromic volley backfired into a segmental spinal pool of motoneurons fails to block a reflex volley completely unless the opposed volleys clash in the motor axons. This is apparently due to the failure of the antidromic volley to conduct from the axon into the soma in some of the motoneurons. In consequence the recovery curves obtained by the use of synaptic stimulation reveal two stages, the first rise being referable to axonal recovery of their motoneurons, the somata of which are not activated by the antidromic volley, the second to recovery of synaptic transmission through the motoneurons in which the antidromic volley does occupy the somata.

The prominence of the initial stage depends upon the number of motoneurons in which the antidromic volley fails to evoke a soma response.

Conduction in the neuron soma is accompanied by refractoriness. (Author's abstr.)

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The Place of Mania among the Depressions from a Biological Standpoint.

In reviewing studies of the biological distinctions between mania and depression, the following conclusions are reached: There seems to be no relation between blood pressure, basal metabolism, blood-pressure reaction to adrenaline, blood-sugar level after administration of ephedrine, sugar-tolerance curves, rate of blood flow, and mood. Differences appear with regard to rate of evacuation of bariumized residue, rate of parotid gland secretion, gastric acidity, and a few blood chemistry measures. No significant differences appear between manic attacks and depressions at biological levels comparing with the gross behavioral differences. Agitated and anxious depressions are apparently much closer biologically to mania than they are to the retarded or deeply preoccupied depressions. Biological contrasts are associated with differences in kind and degree of action rather than mood differences. R. B. AMMONS (Psychol. Abstr.).

Factors Influencing Electrically Induced Convulsions in Rats.

A control group of 12 rats, 7 sex-hormone deficient rats, and 6 vitamin B-complex deficient rats were subjected to electric shock from a floor grid in a small compartment during two experimental periods a day. The first experimental period consisted of 20 shocks at one-second intervals, with the number of shocks being increased by 20 at each succeeding period until coma or breakdown was produced. Both deficiency groups showed more indiscriminate reactions and squealing before onset of coma than did the controls. Coma was produced much more quickly in the sex-hormone deficient and the vitamin B-complex deficient animals than in the control group. R. B. AMMONS (Psychol. Abstr.).

Rorschach Reactions at High Altitudes.

Thirteen male college students were given the Rorschach test under oxygen conditions of sea-level and of 16,000 ft. Sea-level results were also obtained from five other students who were unable to tolerate altitude. Without changing the basic Rorschach pattern, altitude brought decreases in movement and increases in color responses. Changes in three Rorschach ratios, due to altitude, were interpreted as indicating (1) increased responsiveness to external environment, (2) possibly partial loss of resources necessary to cope with stress conditions, (3) increased susceptibility to dangers of outside contacts, (4) attempts at the resolution of conflicts created by the altitude conditions. Rorschach signs, and adjustment ratings by three judges, indicated that the five subjects who failed to adjust to altitude were more maladjusted than the remainder of the subjects. R. B. AMMONS (Psychol. Abstr.).

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Preliminary Report of Electroencephalographic Recordings in Relation to Behavior Modifications. In seeking "to establish evidence of a biological norm that primarily governs the reactions of man," the author's "interest centered specifically upon the physiological reactions associated with the process of attention." He considers cotention to be the organism's primary or total balance of function, as opposed to ditension, the secondary affective deviations of behavior attaching to the symbolic function. Cotention was produced by inducing a kinesthetic awareness of the eyes through the consistent maintenance of balance in oculomotor tensions. Electroencephalographic records from three subjects showed a drop in energy output in the 2–40 frequency range, and a much more pronounced drop in the 8–12 or alpha range, which drop was most marked in the motor regions. Bilateral differences not found in ditention were often found in cotention. Controlled experiments showed the above changes to be specific to cotention and not found under other psychological conditions. R. B. AMMONS (Psychol. Abstr.).

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A Study of the Relationship between Stuttering Occurrence and Phonetic Factors in Oral Reading.

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C. V. HUDGINS (Psychol. Abstr.).

The Frequency of Stuttering in Relation to Word Length during Oral Reading.

Longer words (in terms of letters and of syllables) were found more difficult for stutterers than shorter ones. Phonetic difficulty alone does not explain this fact. "A possible explanation for this is found in terms of the greater prominence of longer words and the stutterer's consequent greater desire to avoid stuttering at those points." Thirty-two stutterers served as subjects.

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*An Evaluation of the Factor of Depression of Brain Metabolism in the Treatment of Schizophrenia. *Bellinger, C. H., et al.* 164

Preliminary Curarization in Electric Convulsive Shock Therapy.

1. The treatment of affective disorders, particularly the depressions, by the induction of *grand mal* seizures is an established, highly-effective procedure.

2. The introduction of the electric shock method has been a material improvement over previous methods.

3. Trauma is still an important but neglected factor in convulsive shock therapy, and the traumatic hazards have not been eliminated by the adoption of electric shock.

4. The traumatic complications are not confined to the vertebrae and the long bones; and sufficient attention has not been given to visceral complications in the form of petechial hemorrhages, increased incidence of tuberculosis, etc.

5. The writers believe that a direct, safe and effective means of eliminating trauma incident to convulsive shock therapy is available in curare, and that straight, unmodified electric shock is unjustified.

6. Preliminary curarization increases the scope of usefulness of convulsive therapy, and makes the treatment available in cases where it might otherwise be contraindicated.

7. Results obtained in 139 cases treated by the combined curare-electric shock method are reported. The best results were seen in the depressions with an increased percentage of complete recoveries in the older age-groups.

8. One death incident to electric shock therapy is reported. (Authors' abstr.)

Diagnosis of Psychogenic Factors in Disease by Means of the Rorschach Method.

If the patient's condition merits the suspicion that psychogenic factors may play an important part in it, have we a tool by which to confirm that suspicion and to estimate the degree of his

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psychological maladjustment? The writer has attempted in this study to show that certain Rorschach criteria, or quantitative signs, may provide such a diagnostic aid.

Five or more of these nine "neurotic signs" (which may easily be determined without the full Rorschach interpretation) were found in the records of 80 per cent. of a group of 74 clinically diagnosed neurotics, and were found in only 15 per cent. of the records of 385 control subjects. It must be emphasized, however, that there is nothing pathognomonic of the record of a neurotic patient in any one of these signs taken alone. Moreover, various groups of maladjusted persons other than clinically diagnosed neurotics may show a higher incidence of these signs than did the normals in this study. Nonetheless, the fact remains that these signs have proved of real value in differentiating those maladjusted patients whose physical conditions were mainly or entirely due to psychological factors, and conversely to point to the basic psychological adjustment of other patients in whom organic lesions responsible for their symptoms were later found.

(Author's abstr.)

Results with Electric Convulsive Therapy in 200 Cases of Schizophrenia.

1. Results in 200 schizophrenics treated with a full course of electric convulsive treatment are reported.

2. Figures on a mixed material being without meaning, the material was broken down according to duration of illness. The rate of remissions (recovered and much improved) is 67·4 per cent. for cases of less than six months' duration, 43·1 per cent. between six months and two years' duration, and 9·2 per cent. in those of more than two years' duration. Older cases with previous remissions have a fair prognosis for the new attack.

3. To facilitate comparison with other statistics, the remission-rate in cases up to one year in duration (56·8 per cent.) and figures for the parole rates of the various groups are also given.

4. The rapid decline of favorable results in cases with longer duration of illness makes early treatment in schizophrenia imperative.

5. Twenty convulsions are the minimum number required in schizophrenia. Discontinuation after ten treatments in patients who are symptom-free at this time leads to relapse in most cases. An insufficient number of treatments is one of the explanations for failures in convulsive therapy.

6. Another factor responsible for apparent differences in results is seen in differences of material. One of the authors (Kalinowsky) obtained poor results in a group of voluntary patients with less acute symptoms in one hospital, and very satisfactory results in institutional material, the subject of this study.

7. A follow-up after one year or more shows a low rate of relapses if full remissions had been obtained.

8. The similarity of results in schizophrenia when using the various shock methods adequately is stressed, and will be more closely examined in comparative studies which are under way. (Authors' abstr.)

The Outcome of Electric Shock Therapy in the New York Civil State Hospitals.

This review of the results of electric shock therapy permits the following conclusions:

1. The results of such treatment of patients with dementia praecox, measured in terms of recovery and much improvement, are not so good as corresponding results with groups of patients treated with insulin.

2. The results are more favorable than those produced by metrazol.

3. Rates of recovery and of improvement among patients with dementia praecox following electric shock therapy are superior to those shown by control series.

4. Electric shock is especially efficacious among patients with manic-depressive psychoses and involutional disorders. (Author's abstr.)

An Evaluation of the Factor of Depression of Brain Metabolism in the Treatment of Schizophrenia.

This investigation was undertaken to determine the effect of depression of brain metabolism in the course of schizophrenia. To evaluate the effect of depression of brain metabolism without any direct stimulatory effects on the brain, patients with schizophrenia were subjected to the nitrogen inhalation therapy. Sixty-five patients ill less than one year and 34 ill for more than one year were treated. Of the patients ill less than one year, 46 per cent. were improved and 34 per cent. paroled. Of those ill longer than a year, 34 per cent. were improved and 9 per cent. were paroled.

From an analysis of these results and a comparison of those obtained with other treatments it may be concluded: (1) That the depression of brain metabolism exerts a desirable effect on the course of schizophrenia. (2) That the duration of depression is of importance. In the treatment of schizophrenia, the longer periods of depression produced by insulin hypoglycemia are more valuable than the shorter ones caused by nitrogen inhalation or metrazol.

(Authors' abstr.)

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*The Development of Paranoic Thinking. *Cameron, N.* 219
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The Bottleneck in Psychology as Illustrated by the Terman Vocabulary Test. *Babcock, H.* 244

The Development of Paranoic Thinking.

1. Current theories of paranoic developments attempt to localize the disorder either in the nervous system or in a "psyche" and assume the opposition of a real and an unreal world. An approach is outlined here that differentiates only between social and individual behaviour, and ascribes delusion to defective socialization.

2. One's attitudes towards one's own conduct get organized through the reactions of others; and the ability to take and shift perspective depends upon how well habits of role-taking are developed in the individual.

3. Ability to shift and to share perspectives is a form of social skill in which individuals vary greatly; under conditions of personal stress, perspectives that are relatively fixed and one-tracked constitute a grave handicap to adjustment. This is especially true among socially taboo matters or those of personal sensitiveness.

4. Surroundings and happenings are organized into an effective environment by one's own responses; and personal sensitiveness here means readiness or ease of response in some direction that operates selectively, in the manner of an anticipatory set.

5. Hypotheses and deductions in the asocial individual lead only to further hypotheses, without being exposed to the modifications which the opinions and perspectives of other persons might otherwise have brought about.

6. Eventually a *pseudo-community* is built up by the paranoic person's reactions to his own preoccupations; individuals around him and fragments of their behavior get organized into an expanding system of delusion. The person begins operations in the social field that have validity only within his own individualistic thinking. Then his measures and counter-measures, in relation to the supposed action of others, bring him into conflict with his environment. The final outcome of such a development is usually that the community isolates him in some way from its active life. (Author's abstr.)

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A Brain-wave Interpretation of Stuttering.

Brain-wave records of 20 adult normal speakers and 20 adult stutterers were made. Comparison of records of 14 separate brain areas for each individual resulted in 44 significant differences (CR = 2·7 or above) between stutterers and normals. In addition, 37 "trend" differences (CR = 2·0 to 2·7) were found. The 81 differences reported indicate that stutterers have larger and more similar alpha waves than normals. This is interpreted to mean that stuttering accompanies reduced consciousness, and to support the cerebral dominance theory of stuttering. W. H. WILKE (Psychol. Abstr.).

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The Value and Limitations of the So-called "Neurotic Signs."

Rorschach protocols of 385 normal subjects and 100 patients referred to a neuropsychiatric clinic were examined from the point of view of the relative incidence of nine previously isolated neurotic signs. All of the patients were referred to the psychologist because of suspicion of psychogenic symptom-formation, but no psychiatric diagnoses were available at the time the test was given. Employing as a criterion of neurosis the presence of five or more signs, the Rorschach correctly selected 80 per cent. of the later psychiatrically-diagnosed neurotics and 85 per cent. of the normals. In a control group of 108 male college students, the 5 per cent. having five or more signs later proved to be maladjusted in some respect. No single sign proved to be unequivocally characteristic. Intensive individual analysis of the case-records suggests the value of a weighting system whereby three points should be given to failure to respond, FC, and shading shock; two points to M and C; one point to F per cent., A per cent. and R; and ·5 point to FM greater than M. E. M. L. BURCHARD (Psychol. Abstr.).

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1. Pharmacology and Treatment.

Intestinal Motility as Influenced through Extrinsic Nerves as a Result of Central Stimulation by Bulbocapnine. Oppenheimer, M. J., Glyer, N. M., and Hamilton, R. H. [*Proc. Soc. Exptl. Biol. Med.*, **51**, 79–80 (1942).]

Bulbocapnine acts centrally and stimulates both sympathetic and parasympathetic systems. It usually elevates blood sugar. It may increase or decrease the amplitude of intestinal contractions, but does not change the rate of contraction. L. E. GILSON (Chem. Abstr.).

The Action of Vitamin B_1 on an Extremity Paralyzed by Experimental Nerve Injury. Musch, H. J., and Rossel, W. [*Klin. Wochschr.*, **20**, 599–600 (1941).]

Vitamin B_1 prevents distinctly the formation of ulcers which usually appear after traumatic nerve injury (nerve crushing) if the guinea-pigs are kept under mechanically unfavorable conditions. RUTH BERGGREN (Chem. Abstr.).

"Shock-delaying" Action of the Barbiturates with a Consideration of the Failure of Oxygen-rich Atmospheres to Delay the Onset of Experimental Shock during Anesthesia. Beecher, Henry K., McCarrell, Jane D., and Evans, Everett I. [*Ann. Surg.*, **116**, 658–67 (1942).]

In experiments with dogs the barbiturates appeared to delay shock in comparison with ether, only when the chief shocking trauma was dehydration or plasma loss from wound surfaces. The administration of approximately 100 per cent. O did not significantly delay, in comparison with room air, the onset of shock due to bleeding under either a barbiturate or ether.
RACHEL BROWN (Chem. Abstr.).

Anticonvulsant Action of Diphenylhydantoin and Some Related Compounds. Knoefel, P. K., and Lehmann, G. [*J. Pharmacol.*, **76**, 194–201 (1942).]

Diphenylhydantoin (I) raises the threshold of electrically produced convulsions in intact cats, but not in decerebrate cats. It does not prevent the production of convulsions by strychnine or cocaine. (I) does not appear as such in the urine of rabbits and dogs receiving large doses of it. Diphenylacetylurea and diphenylthiohydantoin are devoid of anticonvulsant activity. Diphenylbarbituric acid and diphenylenehydantoin have 25–50 per cent. of the anticonvulsant activity of (I), and an equal or somewhat lesser toxicity compared to (I). Large oral doses of fluorenone have a slowly developing anticonvulsant activity.
L. E. GILSON (Chem. Abstr.).

Relationship between the Chemical Structure and Hypnotic Action of Some Aromatic Ketones. Cahen, Raymond. [*Rev. Can. Biol.* **1**, 753–6 (1942).]

The aromatic ketones studied (acetophenone, benzyl ketone, benzophenone, α-hydrindone and β-hydrindone) are not strongly hypnotic on account of their low water-solubility. The

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hypnotic power is increased by cyclization of the side chain. In the ring, the order of the hypnotic power is the same as in the side chain. The proximity of the ketonic group and of the ring increases the hypnotic activity. Among the aliphatic radicals studied, the Et group confers a greater hypnotic activity than the Me group. A. PAPINEAU-COUTURE (Chem. Abstr.).

The Effect of Various Sympathetic-nerve Poisons on the Cerebrospinal Fluid and Blood Pressures. Niimoto, Isao. [*Okayama Igakkai Zassi* (*Mitt. med. Ges., Okayama*), **51**, 1550–63 (*in German*, 1563–4) (1939).]

The site of puncture for the cerebrospinal fluid in urethanized rabbits was chosen between the first cervical vertebra and the occipital bone. The cerebrospinal fluid pressure (I) in the horizontal position averaged 62·6 mm. H_2O and the blood pressure (II) (carotid pressure) 106 mm. Hg. If the (I) is artificially raised, (II) also increases, but if (I) is artificially lowered, (II) undergoes almost no change. Small doses of yohimbine and ergotamine, intravenously administered, raise (II), while large doses lower it. These substances cause an increase in (I) at all the dosages studied. The recovery period is considerably longer for (1) than for (II). The change in (I) produced by adrenaline or adrenalone is proportional to that of (II); adrenaline raises (I), while small doses of adrenalone lower it and large doses raise it. After pre-treatment with ergotamine or yohimbine in certain proportions the (I) raising action of adrenaline and adrenalone is inhibited or reversed. (I) is increased by atropine, while (II) is decreased. Acetylcholine produces an increase in (I) and a distinct decrease in (II). Pilocarpine always lowers (II), but tends to raise (I). In general, the change in (I) appears somewhat later, and also returns to normal somewhat later than is the case with (II). RUTH BERGGREN (Chem. Abstr.).

Action of Benzedrine Sulfate on the Excitability of Nerve, Muscle and Heart in the Frog, Calyptocephalus gayi. Günther, B. [*J. Pharmacol.*, **76**, 369–74 (1942).]

In all cases benzedrine sulfate caused a decrease in excitability through an increase in chronaxia or rheobase, an effect sometimes preceded by a brief period of increased excitability.

Toxicity of Benzedrine Sulfate in the White Mouse and in the Frog, Calyptocephalus gayi. Ibid., 375–7.

For mice the median lethal subcutaneous dose is 270 mgm./kgm. Injected into the ventral lymph sac of the Chilean frog the lethal dose is 280 mgm./kgm. In mice benzedrine poisoning produced signs of nervous hyperexcitability, while in frogs there was immediate diminution and eventual disappearance of all reflexes. L. E. GILSON (Chem. Abstr.).

The Effect of Cholinergic Drugs on Recovery of Function following Lesions of the Central Nervous System in Monkeys. Ward, Arthur A., jun., and Kennard, Margaret A. [*Yale J. Biol. Med.*, **15**, 189–228 (1943).]

In monkeys following the unilateral ablation of areas 4 and 6 of the cerebral cortex, strychnine and thiamine increased the rate of recovery of motor functions. Doryl alone or doryl and thiamine were even more effective. Atropine had no inhibitory action on the recovery under doryl and thiamine. Thiamine has a definite role in the recovery process, but is not entirely responsible. The doryl effect appears, even if doryl medication is not begun for several weeks after the injury. G. H. W. LUCAS (Chem. Abstr.).

2. Biochemistry, Pathology, Physiology, etc.

Liberation of Potassium by Dog Brain during Electrical Excitation. Cicardo, V. H., and Torino, A. [*Rev. inst. Bacteriol. "Carlos G. Malbran,"* **11**, 77–82 (1942).]

See *C.A.*, **36**, 5231[8]. L. E. GILSON (Chem. Abstr.).

The Nitrogen Metabolism of Normal and Decerebrate Pigeons under Conditions of Insomnia. Lemkul, R. A. [*J. Physiol. U.S.S.R.*, **30**, 626–41 (*in English*, 641) (1941); *cf. C.A.*, **36**, 1109[8].

Insomnia produced by keeping the birds under strong artificial, uninterrupted light did not change the general condition of the birds even when continued for two months. Normal pigeons ate less than under normal light, but the N balance remained positive when peas were given as the chief food; corn may lead to a negative N balance. Decerebrate pigeons ate about the same amounts of food under normal and increased light. Their N balance remained unchanged as long as their food had the same N content. The rate of tissue catabolism under the condition of prolonged insomnia was unchanged even if the food contained no N.

C. S. SHAPIRO (Chem. Abstr.).

Nutritional Degeneration of the Optic Nerve in Rats: Its Relation to Tryparsamide Amblyopia. McDermott, Walsh, Webster, Bruce, Baker, Richard, Lockhart, James, and Tomsett, Ralph. [*J. Pharmacol.*, **77**, 24–39 (1943).]

Rats on a diet deficient in vitamin A develop degeneration of the optic nerves. This degeneration is not increased by tryparsamide. Rats given a diet containing all the vitamins except the B group also show degeneration of the optic nerves, and this degeneration is intensified by concurrent administration of tryparsamide. L. E. GILSON (Chem. Abstr.).

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A General Method for the Determination of α-Keto Acids and Its Application to α-Keto Acid Metabolism in Pigeon Brain. Long, Cyril. [*Biochem. J.*, **36**, 807–14 (1942).]

Certain modifications of Lu's method (*C. A.*, **33**, 6896[3]) make it suitable for the accurate determination of 0·1–1·0μ molecule of α-keto acids. The method consists in condensing the keto-acid with 2,4-dinitrophenylhydrazine in acid solution and intensifying the resulting red-brown color by treatment with excess NaOH. Different keto acids show variable absorption intensities. Pyruvic and α-ketobutyric acids are shown to be equally well utilized by washed, minced pigeon brain. S. MORGULIS (Chem. Abstr.).

Experimental Demyelination of the Central Nervous System. III. Poisoning with Potassium Cyanide, Sodium Azide, Hydroxylamine, Narcotics, Carbon Monoxide, etc., with Some Consideration of Bilateral Necrosis Occurring in the Basal Nuclei. Hurst, E. Weston. [*Australian J. Exptl. Biol. Med. Sci.*, **20**, Pt. 4, 297–312 (1942); *cf. C. A.*, **36**, 6646[9]].

Repeated administration of KCN to monkeys led to progressive demyelination, without necrosis, of the cerebral white matter. In distribution the lesions resembled those of Schilder's disease. The encephalopathy did not favor the development of post-vaccinal encephalitis. Repeated massive doses of KCN followed by resuscitation caused widespread necrosis of the cerebral and cerebellar cortex rather than damage of the basal nuclei or white matter. Methylene blue injected intravenously penetrated the damaged brain and remained fixed and unreduced therein for days. In sheep and rabbits the response to KCN was erratic. In monkeys the effects of a single dose of NaN_3 were more lasting than with KCN. Repeated doses of NaN_3 produced necrosis or demyelination in the optic nerves and tracts and necrosis in the caudate nucleus and putamen of the lenticular nucleus. Lesions in other parts of the brain were much less frequent and not severe. In sheep repeated administration of $NH_2OH.HCl$ in amounts compatible with survival for weeks or months did not cause demyelination within periods up to 184 days. Barbiturate poisoning in monkeys caused changes in the white matter of the brain. Sufficient exposure to CO can cause demyelination in the white matter and necrosis of the basal nuclei. In all the above cases the demyelination is probably the result of repeated periods of anoxia, each insufficient to produce lesions in the gray matter. L. E. GILSON (Chem. Abstr.).

Effect of Ablating the Pyriform-amygdaloid Areas and Hippocampi on Positive and Negative Olfactory Conditioned Reflexes and on Conditioned Olfactory Differentiation. Allen, W. F. [*Amer. J. Physiol.*, **132**, 81–92 (1941).]

Four tests were made after and before and after temporal lobe lesions were performed on dogs: (1) Conditioning foreleg reflex to clove vapor, (2) transference of this reflex from one foreleg to the other, (3) establishment of a negative conditioned reflex for asafetida and conditioned differentiation, and (4) differentiation by smell of food from no food. Unilateral extirpation of the pyriform-amygdaloid areas produced little or no effect on these four responses. Bilateral extirpation abolished the third, but none of the others. No effect on taste responses was noted. R. L. SOLOMON (Psychol. Abstr.).

Effects of Lesions of the Periaqueductal Gray Matter in the Cat. Bailey, P., and Davis, E. W. [*Proc. Soc. Exp. Biol., N.Y.*, **51**, 305–6 (1942).]

After developing an electrode that could be inserted into the periaqueductal gray matter of cats by an opening in the occipito-atlantoid ligament through the fourth ventricle, the effects of lesions in this area were demonstrated. The mere insertion of the electrode left behavior unchanged. If the lesion was outside the aqueductal gray matter, only alterations in motor performance were noted. Following slight lesion in this region the cats became very wild, neglecting objects in the environment and acting "as though they saw imaginary menaces." If the lesion was more destructive, this phase was transitory and passed into a state of inert flaccidity in which animals showed no interest in food, no spontaneous activity. There was on occasion some revival of movement after a few days with slow walking on stimulation and placing reactions. H. PEAK (Psychol. Abstr.).

Conditioned Reflexes in Dogs Deprived of the Cortex of One Hemisphere. IV. Examples of Difficult Conditioned-reflex Activity. Rosenthal, J. S. [*Arkh. Biol. Nauk.*, **60**, 114–22 (1940).]

In order to determine the relationship between the excitatory and inhibitory processes, alternating positive and negative tactile stimuli were applied to a dog seven years after the cortex of his right hemisphere had been extirpated. In another experiment the author followed up the overstraining of the excitatory and inhibitory processes by applying the positive stimulus alone, or by changing suddenly all the conditioned stimuli from the 30-seconds trained isolated action to a 3-minutes action. The concentration of the inhibitory process was found to be somewhat decreased, but only temporarily. No other changes were noted. The author concludes that the almost normal level of nervous activity in the partially decorticated dog is probably a stationary phenomenon, and that the substitution function of the hemisphere is preserved for a long time. R. R. HILKEVITCH (Psychol. Abstr.).

Partial Degeneration of the Optic Nerve Associated with Vitamin Deficiency. Verma, O. P. [*Indian Med. Gaz.*, **77**, 646–50 (1942).]

The paper describes cases of "temporal pallor" caused by partial degeneration of the optic

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nerve. In many cases serious impairment of vision occurs. It was revealed that a large percentage of patients were suffering from deficiency diseases (vitamin B_1, riboflavin). The patients were given yeast in doses of 7 gm. daily and shark-liver oil in doses of 60,000 to 80,000 I.U. of vitamin A. Improvement was most satisfactory in cases where the degeneration of the nerve was not too advanced. Conclusion: The condition is due to dietary deficiency.

GERTRUDE E. PERLMANN (Chem. Abstr.).

Nicotinic Acid and Experimental Pellagra in the Guinea-pig. Giorgio, Giovanni, and Solimini, Onofrio. [*Atti Accad. Italia, Rend. Classe Sci. Fis., Mat Nat.* (1), 782–9 (1940).]

Guinea-pigs on a pellagra-producing diet show the same symptoms and survival period whether untreated or treated with nicotinic acid. It is possible that experimental pellagra in this species is different from human pellagra and black-tongue in dogs. Should trigonelline be the pellagra-preventing compound, these experiments indicate that the guinea-pig is unable to methylate nicotinic acid. GIANFRANCO RUFFONI, B. J. JANDORF (Chem. Abstr.).

Multiple Deficiency Features of Pellagra. Sydenstricker, V. P. [*Proc. 8th Am. Sci. Congr.*, **6**, *Pub. Health and Med.*, 65–72 (1942).]

The factors which contribute to the clinical picture of pellagra are discussed and the function of vitamins is explained. Protein deficiency with resulting nutritional edema was present in at least 15 per cent. of patients observed in Sydenstricker's clinic, while anemia caused by Fe deficiency was found in 35 per cent. It is inadvisable to treat symptoms with a single vitamin. When this is done frank manifestations of other deficiencies, hitherto latent, are almost certain to appear. Mixtures of vitamins in adequate therapeutic amounts may be used. An adequate diet supplemented with a single vitamin which is definitely indicated is much more satisfactory. Better still is the administration of yeast or yeast concentrate or the aqueous extract of liver, since these substances furnish the whole B complex of vitamins.

LEOPOLD SCHEFLAN (Chem. Abstr.).

The Nicotinic Acid Economy in Healthy Persons. Hüllstrung, H., and Steitz, F. [*Klin. Wochschr.*, **20**, 612–16 (1941).]

Nicotinic acid amide was determined by the method of Ritsert (*C. A.*, **33**, 8659[3]). The extinction values were lowered by exposure to light, e.g. from 1·155 in sunlight to 0·762 in fainter artificial illumination. The experiments were, therefore, carried out in reaction vessels protected against light. The standard curve obtained agreed practically with that of Ritsert up to 30γ, but at higher concentrations lower extinction values were found. Urine and blood contained 16–230 and 35–400γ nicotinic acid per 100 c.c. respectively. After five days on a diet low in nicotinic acid (tea, zwieback, butter) the urine contained 37–246γ per cent. (four experiments). After loading with 0·1 gm. nikrobion (nicotinic acid amide) the urinary concentration increased somewhat, although the amount excreted consisted of only a fraction (0·22–1·35 per cent.) of the dose administered. In most cases no increase in the blood content was noted after loading.

W. WILBRANDT, RUTH BERGGREN (Chem. Abstr.).

Procedure for Production of a Polyneuritis-like, Experimental (Avitaminosis B_1) Convulsive Condition by Intracerebral Injection of Lactic Acid or Pyruvic Acid. Nitzescu, I. I., and Angelescu, C. [*Z. Vitaminforsch.*, **12**, 82–5 (1942).]

Intracerebral injection of 0·1–0·2 c.c. of either lactic acid or pyruvic acid produced a typical convulsive condition. This confirms the hypothesis of the chemical interference of metabolic products of glucose upon the base of the brain.

T. GORDONOFF, JOSEPH S. HEPBURN (Chem. Abstr.).

Early and Late Neuromuscular Syndromes in Rats Suffering from Avitaminosis E. Differential Characteristics. Demole, V., and Pfaltz, H. [*Rev. Méd. Suisse Romande*, **60**, 464–76 (1940); *cf. C. A.*, **33**, 5042[9].]

RUTH BERGGREN (Chem. Abstr.).

The Behavior of Lipides during Autolysis of Liver and Brain. Sperry, Warren M., Brand, Florence C., and Copenhaver, Wilfred N. [*J. Biol. Chem.*, **144**, 297–306 (1942).]

Cholesterol (I) was neither synthesized nor destroyed during sterile incubation of slices or pieces of rat liver (II) for one to four days, either in saline solution or with nothing added. Although a large loss of tissue solids occurred during autolysis of (II), most or all of the (I) originally present was retained in the intact tissue, with a resulting marked increase in concentration. (I) was concentrated in the same way in severed pieces of (II) left free in the abdominal cavity. There was considerable decomposition of phospholipides (III) in autolyzing (II), but this was proportionally less than the decrease in dry weight of tissue, with the result that (III), like (I), were concentrated in the intact pieces of liver which survived autolysis. No significant changes in (I) or (III) occurred in brain during incubation for one day.

W. M. SPERRY (Chem. Abstr.).

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Disturbances in Lipoid Metabolism and the Central Nervous System. Davison, Charles. [*J. Mt. Sinai Hosp., N.Y.*, **9**, 389–406 (1942).]

RUTH BERGGREN (Chem. Abstr.).

Recent Studies in Epilepsy. Palmer, Harold D., and Hughes, Joseph. [*Penna. Med. J.*, **45**, 1173–7 (1942).] RUTH BERGGREN (Chem. Abstr.).

Cholinesterase and Monoamino-oxidase in Human Central Nervous System. Birkhäuser, H. [*Schweiz. med. Wochschr.*, **71**, 750–2 (1941).]

The following mgm. of acetylcholine were hydrolyzed by 100 mgm. of tissue in 60 minutes in normal cerebra: Thalamus 2·0 (±0·1), caudate nucleus 28·5 (±1·2), putamen 37·5 (±1·05), globus pallidus 9·3 (±0·4), cortex 1·0 (±0·07). The same values were obtained in eleven cerebra of schizophrenics. The mono-oxidase concentrations (c.c. of O used by 100 mgm. of tissue in two hours) were as follows: Thalamus 99 (±17), caudate nucleus 91 (± 16), putamen 91 (± 4), pallidus 97 (± 10), cortex 51 (± 13); the corresponding value in patients below 60 were 87 (± 7), 92 (± 10), 82 (± 5), 67 (± 4), 41 (± 7). The average CO_2 production of 0·5 c.c. of cerebrospinal fluid in 120 minutes (23 normal cases) was 14·0 c.c. (± 1·1); in 18 schizophrenics the figures were 19·4 c.c. (± 1·4). Cholinesterase activity *in vitro* is inhibited by methylene blue, neutral red and Congo red. B. C. P. A. (Chem. Abstr.).

Electrical Activity of Acetylcholine, Choline, Adrenaline and Benzedrine. Beutner, R., and Barnes, T. Cunliffe. [*Biodynamica*, **4**, 47–55 (1942); *cf. C. A.*, **35**, 7431[1].]

An arrangement was described for measuring the p.d. of diluting solutions of drugs in contact with oil layers. Acetylcholine (1 : 300 million) gave a p.d. of 1 mv. in contact with $PhNO_2$, but none in contact with triacetin. Adrenaline generated a negative variation in the same system. Benzedrine produced a variation of lower magnitude but more stability. It also showed a p.d. on triacetin. The negative p.d. produced by minute amounts of drugs may explain the origin of the negative variation on nerve fibers. C. E. P. JEFFREYS (Chem. Abstr.).

Distribution of Choline Substances in the Animal Organism. Choline and Choline Esters in Neoplasms of the Nervous System. Vincent, D., Daum, S., and Bouchet, M. [*Trav. Membres Soc. Chim. Biol.*, **23**, 1363–8 (1941).]

In malignant tumours of various parts of the human brain the choline and choline ester contents were usually considerably above the normal for the corresponding healthy tissues.

L. E. GILSON (Chem. Abstr.).

Occurrence of Brain Hemorrhages in Choline-deficient Rats. Jervis, Geo. A. [*Proc. Soc. Exptl. Biol. Med.*, **51**, 193–5 (1942).]

Hemorrhagic lesions of the cerebellum occurred in the young of mother rats maintained during pregnancy on a diet high in cystine and deficient in choline.

L. E. GILSON (Chem. Abstr.).

The Relation Between Blood Coagulation and the Central Nerves: Supplementary Report on the Center which Promotes Blood Coagulation. Aoyama, Tutomu. [*Okayama Igakkai Zassi (Mitt. med. Ges. Okayama)*, **51**, 2564–76 (*in German*, 2576–7) (1939).]

The coagulant action of central origin exerted by bulbocapnine, harmaline, harmine and cocaine is almost completely inhibited by barbital or phenobarbital and slightly diminished by chloral hydrate, but is not markedly affected by urethan. The coagulant action of these four poisons is more pronounced in rabbits in which the cerebral cortex has been removed than in normal rabbits. It can probably be assumed that the chief cause of the phenomena is a blood-coagulation-promotion center which exists as a part of the center for regulation of blood coagulation in the diencephalon, and that this centre is stimulated by bulbocapnine, harmaline, harmine and cocaine, but is paralyzed by barbital and phenobarbital. The cerebral cortex can inhibit this coagulation-promoting center; paralysis or removal of the cerebral cortex causes intensification of the excitability of this center and of the action of the above four poisons. In a certain part of the diencephalon there are apparently two regulatory centers of blood coagulation, one of which promotes and the other inhibits coagulation. These regulatory centers are inhibited by the cerebral cortex; they appear to control the regulatory function of the peripheral sympathetic nerves for the blood coagulation. RUTH BERGGREN (Chem. Abstr.).

Fatigue of Patients with Circulatory Insufficiency, Investigated by Means of Fusion Frequency of Flicker. Enzer, N., Simonson, E., and Blankstein, S. S. [*Ann. Intern. Med.*, **16**, 701–7 (1942).]

Of 22 cardiac or hypertensive patients all except two fully compensated valvular cases had values for fusion frequency lower than the lowest in 47 normal subjects, i.e. the fusion frequency of slightly decompensated patients during rest is as low as in some normal subjects in a state of pronounced fatigue. The decrease must be attributed to oxygen lack in the visual pathway and to a certain extent in the entire nervous system. It is a permanent fatigue of the nervous system, which explains the decreased capacity of cardiovascular patients even for work involving

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slight or no muscular effort. It also suggests the physiological background for fatigue of norma persons in these kinds of work. Practically, fusion frequency may be used to judge both the actual state of cardiovascular patients and their capacity for work.

M. E. MORSE (Psychol. Abstr.).

The Emotional Component of the Ulcer-susceptible Constitution. Draper, G. [*Ann. Intern. Med.*, **16**, 633–58 (1942).]

This study of 80 male peptic-ulcer patients shows that their psychological pattern is as characteristic as their morphological and physiological pattern. They are linear, vagotonic, androgynic, intelligent, and futilely dynamic. The essential emotional factors are chronic fear and guilt. The sense of security in males rests primarily on a sound and powerful body. The ulcer subject senses this implication keenly in reference to his puny frame and feminine component, and feels that security lies in an eager effort to recapture the maternal protectorate through the infant's life-line—food. Neither simple nor deep psychotherapy is especially successful. If the patient's emotional pattern is a correlate of his constitution, it cannot be radically changed, but his capacity to adjust to stress can be evaluated. The symbolism of bed rest and frequent small feedings of milk tendered by nurse hinders the establishment of self-reliance. There are reports of remarkable successes in feeding regular diets even in severe cases.

M. E. MORSE (Psychol. Abstr.).

The Frontal Lobes, the Prefrontal Lobotomy and the Psychoses. Wynegar, D. E. [*Delaware St. Med. J.*, **14**, 96–9 (1942).]

The operation, briefly described, separates the pre-rolandic from the post-rolandic cortex. The pre-rolandic area is concerned with the projection of the self into the future. After the operation the patient loses his self-critique, is more easily satisfied, and lacks the social sense. The superego completely vanishes, and nothing remains but an already patterned behaviour based upon the operations of the former superego. The frontal lobe no longer experiments and plans, and thus no longer is frustrated. The basis of conflict is gone. No possibility of psychosis exists. Two cases are cited illustrating changes in symptomatology following lobotomy.

M. W. KUENZEL (Psychol. Abstr.).

Neuropsychiatric Disturbances in Internal Disease; Metabolic Factors and Electroencephalographic Correlations. Engel, G. L., and Margolin, S. G. [*Arch. Intern. Med.*, **70**, 236–59 (1942).]

The oxygen and dextrose requirements of the brain form the basis for a report of cases of generalized disease in which neuropsychiatric symptoms were ascribable to these factors. The response to therapy directed toward the underlying metabolic defect suggests a rational approach to treatment of psychiatric complications in certain internal diseases. The value of the EEG in identifying these disturbances is demonstrated and its wider use in internal medicine indicated. In acute cerebral anemia bursts of slow potentials accompanied the symptoms. In chronic cerebral anemia due to impaired respiratory exchange the development of neuropsychiatric symptoms was accompanied by slowing and irregularity of the waves. The effects of disturbed carbohydrate metabolism in Addison's disease and various toxic and deficiency states were manifested by bursts of abnormally slow waves and unusual sensitivity to hyperventilation. Improvement of mental symptoms, carbohydrate metabolism and the EEG went hand in hand. The defect in carbohydrate metabolism in these cases suggested, not simple hypoglycemia, but a lowered threshold of cerebral reaction, possibly due to inefficient utilization of available sugar by the nervous system.

M. E. MORSE (Psychol. Abstr.).

Neuroses in Wartime, from Personal Experiences. Goldstein, K. [*Tufts med. J.*, **8**, 1–7 (1941).]

The actual statistical incidence of war neurosis cannot be determined, and little is known of the incidence except that it is high during a protracted war and that neurotic soldiers constitute a difficult problem for both the physician and for society. In the author's experience, 10 per cent. of war neuroses actually represent sequelae of brain injury. The true neuroses may be divided into three categories: (1) Those occupying a position half-way between organic disease and neurotic disorder, the somatic neuroses; (2) the abnormal fatigue and exhaustion neuroses; and (3) the neuroses proper, that is, the anxiety neurosis and the conversion hysteria. The author then proceeds to discuss in detail the clinical aspects of these conditions, concluding with a discussion of the problems of therapy, and with emphasis upon the need to eliminate from military service those mentally unsuitable as a measure of reducing the incidence of neuroses in wartime.

M. H. ERICKSON (Psychol. Abstr.).

The Role of Mild Cerebral Commotion in War Neurosis. Neustatter, W. L. [*Proc. R. Soc. Med.*, **35**, 549–52 (1942).]

The author compared three groups of 30 cases showing psychiatric disorders: (1) Soldiers unexposed to enemy action; (2) soldiers and civilians exposed to enemy action, although uninjured; and (3) cases suffering slight cerebral commotion. From the evidence obtained the following conclusions are made: (1) There is no evidence of a physiogenic cause for the psychoneurosis, although physiological causes may prevent the subsidence of anxiety symptoms. (2)

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Organic post-concussive symptoms may be co-existent with psychogenic symptoms where the latter are prominent, and may also be masked by them. J. E. ZERGA (Psychol. Abstr.).

Analysis of the Mental Defect in Chronic Korsakov's Psychosis by Means of the Conditioned Reflex Method. Gantt, W. H., and Muncie, W. [*Johns Hopk. Hosp. Bull.*, **70**, 467–87 (1942).]

There is no unanimity of explanation of the defect in Korsakov's psychosis, and analysis has seldom extended beyond bare statements and descriptions. The present authors' patients were tested for ability to react defensively to an anticipated unpleasant stimulus (electric shock). The results showed uniformly a disturbance of retention and memory in the presence of an intact sensorium; inability to form new responses, although old responses and verbal associations are retained; and complete inability to analyze and synthesize (due primarily to defect of the time factor), unaided by verbalization. A distinction must be drawn between spontaneous and verbally aided performance. Commands could be executed. The patient's verbal formulation sometimes determined performance, but frequently incompatible motor and verbal formulations betrayed thinking disorder. New experiental data was more difficult than impersonal data, either new or old. Rounding-out of experience by random activity and confabulation may be related to the patient's euphoria or previous personality. M. E. MORSE (Psychol. Abstr.).

The Electroencephalogram and Pneumoencephalogram in Non-focal Neurological Disorders. Trowbridge, E. H., jun., and Finley, K. H. [*Amer. J. Roentgenol.*, **47**, 699–702 (1942).]

With 68 patients suspected of neurological disorder, abnormal EEG's were as frequent in cases with normal as in cases with abnormal pneumoencephalograms. Slow activity was common in cases showing dilated ventricles. Normal EEG was found for some cases showing cortical atrophy, but never in cases with dilated ventricles, even without cortical atrophy. It is concluded that the EEG may be an adjunct to, but not a substitute for, pneumoencephalography.
E. S. PRIMOFF (Psychol. Abstr.).

Electroencephalographic Studies: A Method for Differential Diagnosis of Abnormal Electroencephalograms. Strauss, H. [*J. Mt. Sinai Hosp., N.Y.*, **9**, 17–22 (1942).]

Irregular delta activity may be indicated by percent. delta-time and by an "abnormality index" in which time is multiplied by highest voltage and divided by lowest delta frequency. Eleven electrodes were used with a number of subjects; 6 types of record were noted on the basis of symmetry of readings from points on either side of head, and of abnormal delta times. Highly abnormal records were associated with active types of pathology, as fast growing tumours; asymmetrical records were found only with cerebral lesions.
E. S. PRIMOFF (Psychol. Abstr.).

Blood-sugar Level and Influence of Hyperventilation on Slow Activity in Electroencephalogram. Rubin, M. A., and Turner, E. [*Proc. Soc. Exp. Biol., N.Y.*, **50**, 270–2 (1942).]

One physically healthy schizophrenic patient was observed on ten different occasions over a period of ten weeks, hyperventilation records at various blood-sugar levels being obtained. Lowering blood sugar below 120 mgm. per cent. may influence the response of the EEG to hyperventilation. Consequently it is advisable to keep blood sugar at a level of 120 mgm. per cent. when the EEG is recorded during over-ventilation. H. PEAK (Psychol. Abstr.).

Endocrine Aspects of Mongolism. Benda, Clemens E. [*J. Clin. Endocrinol.*, **2**, 737–48 (1942).]

On the basis of clinical and autopsy studies of 38 cases, Benda concludes that mongolism follows a pathological gestation which results in a poorly functioning pituitary. Hence thyrotropic, adrenotropic and gonadotropic stimulation is not adequate for the developmental needs of early infancy, and still less so for those of puberty. The desirability of early treatment is stressed, but therapy with present preparations is not considered feasible.
KATHRYN KNOWLTON (Chem. Abstr.).

The Chemical Composition of the Spinal Fluid in Apes (Pavian and Makaki). Kaminskii, S. D., Mintsev, A. I., and Lebedinskaya, G. A. [*J. Physiol. U.S.S.R.*, **30**, 535–6 (1941).]

The spinal fluid of apes 1·5 to 15 years old differs from human spinal fluid in that it is higher in Cl and more nearly constant in composition. C. S. SHAPIRO (Chem. Abstr.).

The Effect of Hexoses and Pentoses on the Formation in vitro of Phospholipide by Brain Tissue as Measured with Radioactive Phosphorus. Schachner, H., Fries, B. A., and Chaikoff, I. L. [*J. Biol. Chem.*, **146**, 95–103 (1942); *cf. C. A.*, **36**, 5528[8].]

The rate of conversion of inorganic P^{32} to phospholipide P^{32} in rat brain slices incubated in Ringer bicarbonate medium is increased approximately three times on addition of 0·02 M fructose, five times on addition of 0·02 M glucose, mannose or galactose. Addition of rhamnose or arabinose has no effect. The stimulation due to hexoses is not found with brain homogenate, or with slices under anaerobic conditions. Glucose increases the rate of penetration of inorganic P^{32} into the slices, though not sufficiently to explain the increase in recovered phospholipide P^{32}. Total and inorganic P of brain slices incubated for two hours is the same in presence as in absence of added glucose. B. J. JANDORF (Chem. Abstr.).

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Occurrence of Sphingomyelin in Tissues of the Cat. Hunter, F. Edmund. [*J. Biol. Chem.*, **144**, 439–45 (1942); *cf. C. A.*, **35**, 2977[5].]

Phospholipides (I) were extracted from eleven cat tissues. Total (I) were determined by P determination and sphingomyelin (II) by a modification of the preparation as reineckate. The tissues were found, on a wet weight basis, to fall into the following order of decreasing concentration of (II): Brain, lung, kidney, spleen, intestinal mucosa, liver, intestinal muscle, heart, blood corpuscles, skeletal muscle, plasma. No correlation could be found between the concentrations of total (I) and of (II) in individual tissues. B. J. JANDORF (Chem. Abstr.).

Studies on the Metabolism of Brain Suspensions. II. Carbohydrate Utilization. Elliott, K. A. C., Scott, D. B. McNair, and Libet, B. [*J. Biol. Chem.*, **146**, 251–69 (1942); *cf. C. A.*, **36**, 3268[1].]

The respiration and R.Q. of rat brain homogenates in Ringer solution containing Mg but no Ca is measured in the presence of glucose (I), pyruvic acid (II), lactic acid (III) or acetic acid (IV). Duplicates are analyzed for changes in the concentrations of these compounds. In absence of added substrate approximately 76 per cent. of the respiration is accounted for by combustion of non-carbohydrate material (R.Q. = 0·87). On addition of (I) or (II) (optimally 10 mgm. per cent.) oxidation of non-carbohydrate material is largely suppressed. Approximately 14 per cent. of the (II) utilized can be accounted for as (III) and an equivalent amount of (IV). In presence of both (I) and (II) more (II) disappears; the amount of (III) produced is greater than the sum of (III) produced from either (I) and (II) alone. (III) in normal brain homogenates does not suppress the oxidation of non-carbohydrate material as efficiently as do (I) or (II); in brain from insulinized rats, combustion of (III) accounts for 92 per cent. of the respiration as compared with 73 per cent. in normal homogenates. In presence of both (I) and (III) only (I) is oxidized. (IV) does not affect the respiration and is not metabolized.

B. J. JANDORF (Chem. Abstr.).

Isolation of Dihydrosphingosine from Brain and Spinal Cord. Carter, Herbert E., and Norris, William P. [*J. Biol. Chem.*, **145**, 709 (1942).]

This reduction product was isolated by acetylation and identified as triacetyldihydrosphingosine. It had not previously been found in nerve tissue.

E. L. GREEN (Chem. Abstr.).

Studies in the Phosphorus Compounds of Brain. III. Determination of Adenosine Triphosphate and its Decomposition Products in Fresh and Autolyzed Dog Brain. Kerr, Stanley E., with the technical assistance of Krikor Seraidarian. [*J. Biol. Chem.*, **145**, 647–56 (1942); *cf. C. A.*, **35**, 6639[6].]

Methods are not available for separating adenosine triphosphate and diphosphate, adenylic acid and inosinic acid, so attention was confined to amounts of nucleotide and nucleosides plus free purine, acid-hydrolyzable P combined with the nucleotide and adenine and hypoxanthine in both the nucleotide and nucleoside-free purine fractions. Methods are described for analysis of the purines and the acid-hydrolyzable P attached to the nucleotide after separation of the nucleotides from the trichloroacetic acid filtrate by preparation with mercuric acetate. Dog brain frozen *in situ* with liquid air contains 190 p.p.m. acid-soluble purine nucleotide, 20 p.p.m. nucleoside and free N. 83·5 per cent. of the nucleotide N represents adenine. Preliminary studies indicate that the remainder is guanine rather than hypoxanthine. The amount of acid-hydrolyzable P found attached to the nucleotide is close to that required for complete phosphorylation. During autolysis loss of acid-hydrolyzable P begins within five seconds, reaching a level corresponding to adenine diphosphate in about three minutes, after which the nucleotide N slowly decreases to half the normal level within an hour with a corresponding increase of nucleoside and free purine. No formation of inosinic acid is observed during one hour of autolysis. Adenine together with hypoxanthine and ribose is found in the nucleoside-free purine fraction, the adenine increasing during autolysis. The decomposition of nucleotide to nucleoside and free purine with a gradual decrease of adenine in the nucleoside fraction and no increase of inosinic acid suggests that adenlyic acid in brain is first decomposed by a phosphatase rather than a deaminase. E. L. BREEN (Chem. Abstr.).

Effects of Anoxia at Birth on Central Nervous System of Guinea-pig. Windle, W. F., and Becker, R. F. [*Proc. Soc. Exptl. Biol. Med.*, **51**, 213–15 (1942).]

Anoxia induced at birth invariably produced symptoms of neural damage. More than eight minutes of anoxia caused permanent inactivation of certain areas of the brain and spinal cord.

L. E. GILSON (Chem. Abstr.).

Serine as the Nitrogen-bearing Constituent of the Glycerophosphatide of Human Brain.: Preliminary Communication. Schuwirth, Karl. [*Z. Physiol. Chem.*, **270**, 1–111 (1941).]

Schuwirth can identify serine in the brain phosphatides of human beings (*cf.* Folch and Schneider, *C. A.*, **35**, 1107[1]; Chargaff, Ziff and Rittenberg, *C. A.*, **35**, 2951[4]; Folch, *C. A.*, **35**, 4787[9]) in the form of the β-naphthalenesulfonic acid complex. The glycerophosphatide is

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separated from the ether extract of brain with $Ba(OH)_2$ solution, freed from Ba, concentrated to a syrup in vacuum and extracted with alcohol. From the residue serine is isolated as the β-naphthalenesulfonate through recrystallization from hot H_2O, glacial AcOH and 20 per cent. alcohol. GOTTFRIED BECK, MORRIS B. JACOBS (Chem. Abstr.).

Action of Some Acids on the Frog Spinal Cord and Nerve-muscle Irritability. Lueken, B. [*Z. Biol.*, **100**, 535–53 (1941); *cf. ibid.*, **100**, 486–517.]

Tests were made with the gastrocnemius muscle preparations in acid, the nerve in Ringer solution. Effect of varying stimulation was registered on the kymograph. Valeric and caproic acids in concentrations of 0·01 N and 0·001 N and salicylic acid of 0·04 to 0·1 per cent. showed similar irreversible reactions of the spinal preparations. Shortly after treatment violent spasms occurred either spontaneously or as a result of reflected irritability, continuing for a while even when out of the acid solution. Symptoms of paralysis were also observed. The muscle-nerve preparations were treated with acid concentrations beginning at the same high point but reaching a dilution 20 to 40 times that used above. Though spontaneous contractions occurred in the more concentrated solutions, strong delayed activity of tetanic character was called forth by the medium concentration. Ca-ion withdrawal is considered responsible.

N. SCHEINFINKEL, FRANCES KRASNOW (Chem. Abstr.).

Metabolism of the Central Nervous System in Experimental Poliomyelitis. Racker, E.; and Kabat, Herman. [*J. Exptl. Med.*, **76**, 579–85 (1942).]

During paralysis the brain of the mouse infected with poliomyelitis virus shows on test after mincing a decrease in anaerobic glycolysis with no significant change in O utilization; the decrease varies from 5 to 50 per cent. NaF produces a greater inhibition of anaerobic glycolysis in normal than in poliomyelitic brain. Dehydrogenase activity is higher for poliomyelitis-infected brain without added substrate. This difference from normal disappears when substrates are added. The ratio of anaerobic glycolysis/O utilization for the sliced motor cortex is higher than for sliced visual cortex of the dog and cat. The O consumption of the anterior horn of the sliced spinal cord of dog and cat is much less than that of the cerebral cortex. The findings are in keeping with the view that at a certain stage of the infection the nerve cells may be reversibly injured but not yet destroyed by the virus. C. J. WEST (Chem. Abstr.).

Crystallization of a Protein from Poliomyelitis-infected Mouse Brain. Racker, E. [*Science*, **96**, 364–5 (1942).]

The isolation and crystallization of the fraction are described. It is birefringent and is essentially protein in nature. It is highly infective for mice, producing typical symptoms of poliomyelitis 14–72 hours after intracerebral inoculation. L. E. GILSON (Chem. Abstr.).

The Influence of Bulbocapnine on the Blood Sugar of the Rabbit. (1) *The Influence on Hyperglucemia of Central Origin. Asakawa, Hisasi.* [*Okayama Igakkai Zassi* (*Mitt. med. Ges. Okayama*), **51**, 792–804 (*in Japanese*) (*in German*, 804–5) (1939).]

Bulbocapnine (I), in doses of 10–20 mgm. per kgm., produces a moderate hyperglucemia in rabbits; the intensity and duration of the hyperglucemia parallel the dose injected. A similar hyperglucemia is produced upon repeated administration of (I), i.e. the sugar metabolism does not develop a tolerance for (I). The (I) hyperglucemia is inhibited by pretreatment with yohimbine, barbital (60 mgm./kgm.) and phenobarbital (30 mgm./kgm.) and by bilateral splanchnicotomy, and is intensified by urethan (0·8 gm./kgm.), chloral hydrate (0·2 gm./kgm.), antipyrine and $MgSO_4$; it is scarcely perceptibly affected by atropine. (I) stimulates the sugar center; the impulse reaches the adrenals, liver and other abdominal organs by way of the splanchnic nerve and results in liberation of adrenaline, splitting of glycogen in the liver and thus in hyperglucemia. The point of attack of (I) lies in the brain stem, especially in the so-called hypothalamus sugar center according to Aschner, *et al.* (*C. A.*, **27**, 3984) and in the corpus striatum sugar center according to Dresel and Lewy; the latter sugar center is more highly developed than the former. The parasympathetic nerves probably play no part in the appearance of this hyperglucemia.

(2) *The Relation Between Bulbocapnine Hyperglucemia and Experimental Hyperglucemia and Hypoglucemia and the Influence on the Adrenaline Content of the Adrenal Glands and the Glycogen Content of the Liver.* [*Ibid.*, 806–14 (*in Japanese*) (*in German*, 814–15).]

In general, morphine hyperglucemia is intensified by (I), i.e. this poison exerts an additive action; in individual experiments, however, this effect is not always distinct. (I) suppresses considerably diuretin hyperglucemia and distinctly inhibits the hyperglucemia produced by glucose infusion. (I) generally inhibits insulin hypoglucemia and under certain conditions can even produce hyperglucemia. (I) distinctly diminishes the adrenaline content of the adrenal glands; this action is inhibited by pretreatment with ergotamine. (I) produces a striking reduction in the glycogen content of the liver.

(3) *The Relation Between Bulbocapnine Hyperglucemia and the Adrenal and Thyroid Glands and the Detoxication of Bulbocapnine.* [*Ibid.*, 1007–19 (*in Japanese*) (*in German*, 1019–20).]

(I) hyperglucemia is considerably suppressed by one injection of interenin (a preparation

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of cattle adrenal glands); repeated subcutaneous injection of 1 c.c. interenin per kgm., however, has almost no effect on the action of (I) on the blood sugar. (I) hyperglucemia is distinctly intensified by one injection of adrenaline, but is considerably reduced by repeated injections. (I) hyperglucemia is slightly inhibited by one injection of thyroxine, and slightly intensified by repeated administration of thyroxine. (I) hyperglucemia is markedly intensified in the thyroidectomized rabbit; it is considerably diminished in the thyroidectomized rabbit by pretreatment with thyroxine. (I) hyperglucemia is attributed to a sympathetic action. The adrenal cortex and the thyroid play an essential role in the detoxication of (I).

RUTH BERGGREN (Chem. Abstr.).

The Effect of Anoxia on Brain Potentials of Hyperthyroid Animals. *Kessler, M., and Gellhorn, E.* [*Am. J. Physiol.*, **137**, 703–5 (1942).]

The administration of thyroid powder or of thyroxine increases the senstivity of unanesthetized rats to 7 per cent. O_2 or lowered barometric pressure as shown by the greatly accentuated effects of anoxia on the electroencephalogram. E. D. WALTER (Chem. Abstr.).

Distribution of Neuraminic Acid in the Brain. (*With a Micromethod for the Estimation of this Substance in Nerve Tissue.*) *Klenk, E., and Langerbeins, H.* [*Z. Physiol. Chem.*, **270**, 185–93 (1941).]

Neuraminic acid, *cf. C. A.*, **36**, 3204[3], is a characteristic cleavage product of a sugar-rich lipoid which occurs in small quantities in the normal brain but constitutes the chief constituent of the protagon fraction (*cf.* Savy, Etienne-Martin and Receveur, *C. A.*, **31**, 4391[3]; Blix, **33**, 713[1]) in infantile amaurotic idiocy (Tay-Sachs type). Neuraminic acid can be detected by the orcinol reaction. (Reagent: 40·7 c.c. concentrated HCl; 0·1 gm. orcinol; 1 c.c. 1 per cent. $FeCl_3$ solution diluted to 50 c.c.) About 30 mgm. of normal brain or correspondingly less of pathological tissue suffices for the reaction. Neuraminic acid is present only in the pure gray matter of the brain. One c.c. of the solution under investigation is heated with 1 c.c. of the reagent for five minutes in a paraffin bath at 142°, centrifuged and evaluated photometrically. A red to red-violet coloration is obtained. Galactose gives a green coloration and interferes only if in large excess. There are 36–38γ of neuraminic acid in 187·5 mgm. of fresh brain (gray matter of the cortex). GOTTFRIED BECK, MORRIS B. JACOBS (Chem. Abstr.).

The Changed Chemistry of Brain Tissue in the Psychotic. *Barondes, R. de R.* [*Med. Record*, **155**, 537–8 (1942).] RUTH BERGGREN (Chem. Abstr.).

Proteinase in Brain. *Kies, Marian W., Schwimmer, Sigmund, and Walden, M. K.* [*J. Biol. Chem.*, **145**, 685–91 (1942).]

Partially purified brain proteinase is of the catheptic type. Di- and tri-peptidases are present in brain tissue. Lipolytic enzyme is absent. Compared with muscle, a large amount of cathepsin (I) is present. The brain does not autolyze more rapidly than muscle. While (I) contributes to the deterioration of brain tissue put out for comparative purposes, an adequate explanation for the rapid spoilage is still lacking. T. LAANES (Chem. Abstr.).

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The following names are printed in SMALL CAPITALS: authors of original articles and of books reviewed. Names of authorities referred to in the text are in ordinary type.

(R.) indicates a *Review*; the title of the book reviewed is followed by the author's name thus: "Psycho-analysis and its Derivatives, by H. Crichton-Miller (R.)."

(E.) indicates the *Epitome* section; the title of the abstract is followed by the author's name, thus: "Age and human ability. Miles, W. R. (E.)."

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